

November 26, 1962

Aviation Week & Space Technology

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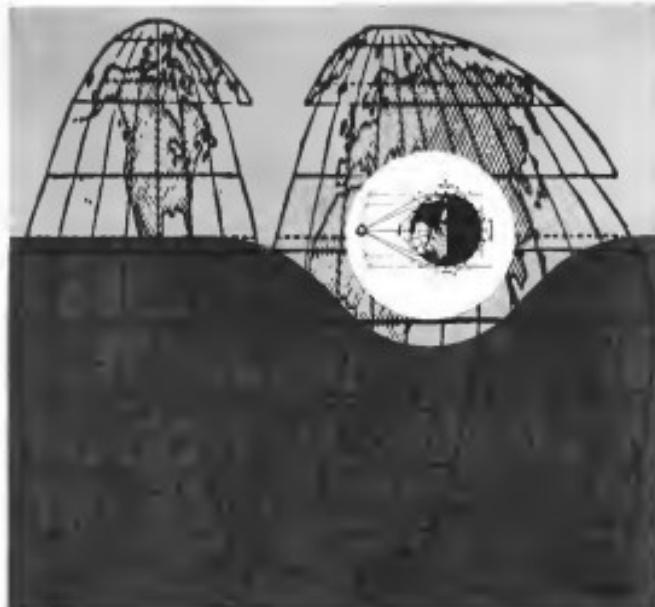
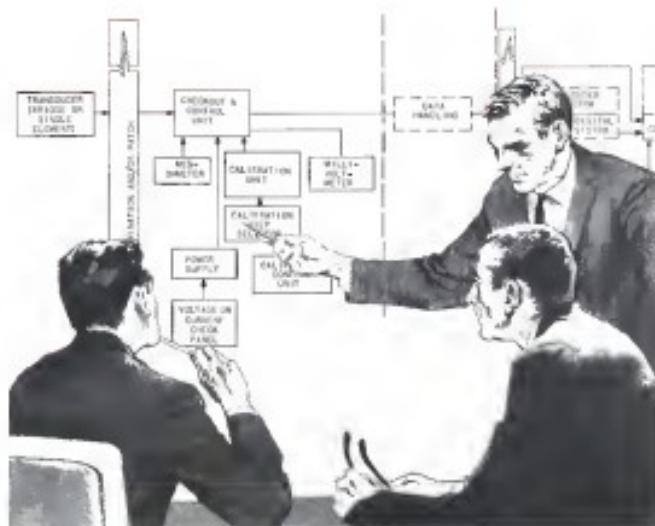


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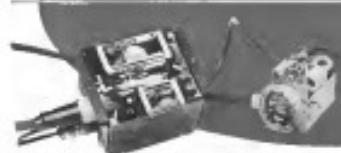
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- Dec. 3-5-British Armed Forces International Air Staff Seminar, Flight Safety Facility, Wiesbaden, West Germany, via DAFSTOR transmission and by translation.

Dec. 4-6-19th Joint Computer Conference, University of Florida, Gainesville, Fla., joint American Federation of Information Processing Societies, IEEE.

Dec. 4-6-1965 Conference National Area Team Trade Show, Flamingo Hotel, Las Vegas, Nev.

Dec. 4-12-Award National Air Show Committee, Flamingo Hotel, Las Vegas.

Dec. 5-Annual Defense Meeting, Strategic Studies Assn., University Inn Hotel, Los Angeles Calif., Gold Spurri, Calif. Mar.

Dec. 6-7-Veteran Communicators Conference, 1000 DeAnza Hotel, Los Angeles, Calif.

Dec. 10-13-Fifth Annual Symposium on Computational Journal Series, Defense Dept., Research and Engineering Division, Research and Development Center, Farmington Hills, Mich., sponsored by Naval Weapons & Materials Aviation Corp., in cooperation with AFMC Scientific and Technical Liaison Office.

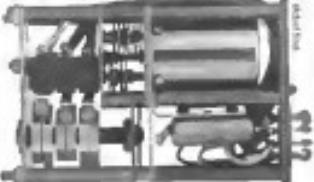
Dec. 11-13-Workshop on VTOL Aircraft, New York Academy of Science, Henry Holt Hall, New York, N.Y.

Dec. 16-20-International Arms Control Symposium, University of Michigan, Ann Arbor, Mich., co-sponsoring institution, University of Michigan Law School, Institute of International Law.

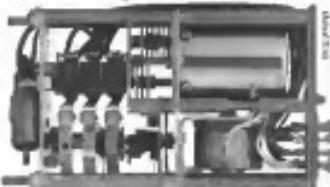
Dec. 24-H-1966 Paris, France, meeting, Assoc.

(Continued on page 7)

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November 26, 1963

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AEROSPACE CALENDAR

(Extracted from page 5)

- ern Rocket Society and American Anti-Aircraft Association of Science, Philadelphia, Pa.

Dec. 12-14—Aerospace Engineering Society Symposium on Systems Engineering. Hotel Penn, Philadelphia, Pa. 7495-Wohlgemuth and Schatzkramer, Chairmen; Institute of Radio Engineers, Chairman, Plaza Hotel, Orlando, Fla.

Jan. 15-18—19th Annual Convention. Technical Areas of Aviation, California Hotel, San Jose, Calif., Calif.

Feb. 1-3—Symposium on Engineering Concepts and Experiments. Society of Automotive Engineers, Hotel Del Espana, Miami Beach, Fla.

Feb. 21-23—11th Annual Meeting. including Wright Brothers Lecture, Institute of the Aerospace Sciences, Hotel Astor New York, N.Y.

Feb. 24-26—14th Annual Meeting. American Scientific Society, New York, N.Y.

Mar. 12-14—North American Symposium on Reliability and Quality Control. Sheraton-Park Hotel, San Francisco, Calif.

Mar. 25-27—12th Annual Army Aviation Convention. Society of Automotive Engineers, Hotel Maryland, Washington, D.C., Wash. National Aeromedical Research Agency.

Apr. 30-May 1—10th Annual Solid Propellant Rocket Conference. American Rocket Society, Belvoir Stationed Hotel and The Franklin Inn, Philadelphia, Pa. 510-Bell Telephone Co., White Plains, N.Y. 2nd U.S. Military Electronic Institute, Institute of Radio Engineers, Ambassador Hotel, Los Angeles, Calif.

Feb. 16—Symposium on Engineering for Major Scientific Programs. Georgia Institute of Technology, Atlanta, Ga.

Feb. 17-18—National Symposium on UNISOCO Building Fund. Sponsor: International Scientific Radio Union, Office of Naval Research, La Follette National Industrial Electronics.

Feb. 21-22—Solid Rocket Thermal and Structural Mechanics. Institute of the Aerospace Sciences, Cleveland, Ohio. Sponsored by Defense Civil Board, Dept. of Defense, Eight Aerospace Laboratories.

Feb. 28-March 1—1963 International Solid-State Devices Conference. Philadelphia Pennsylvania Institute of Radio Engineers, Associate Member, Institute of Electrical and Electronic Engineers, University of Pennsylvania.

Mar. 24-25—Preliminary Meeting. Institute of the Aerospace Sciences, Cleveland, Ohio.

Mar. 12-13—Electro Propulsion Conference. American Rocket Society, Ambassador Hotel, Calabria Springs, Calif.

Mar. 18-20—Space Vehicle Testing. Conference of the Rocket Society and Institute of the Aerospace Sciences, Cocoa Beach, Fla.

Mar. 21-23—1963 Western Material Exposition and Congress. San Pacific Auditorium and Ambassador Hotel, Los Angeles, Calif.

May 18—19th Annual Air Force sponsored Symposium on Sensors. Biltmore Hotel, Dayton, Ohio.

May 25-26—International Convention. Institute of Radio Engineers, Wyndham Astor and Colgate, New York, N.Y.



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AEROSPACE CALENDAR

(Continued from page 7)

- Apr. 1-Baldwin Aeronautical Materials Conference, American Society of Lubrication Engineers, El Monte Hotel, Palm Springs
- Apr. 23—North American Aerospace Aircraft Safety Seminar, Flight Safety Foundation, 1000 Madison Plaza, New York, N.Y.
- Apr. 24-Opening Conference, Airport Operators Council, Sheraton Hotel, Washington, D.C.
- Apr. 19-21—Final Symposium on Engineering Aspects of Megameteoroids, University of California, Berkeley
- Apr. 19-21—Space Rocket Society of America, Source of Knowledge, Engineers Naval Warfare Laboratory, White Oak, Md.
- Apr. 19-21—International Nuclear Magnetron Conference, Sheraton Hotel, Washington, D.C., Sponsored by Institute of Electrical Engineers, IEEE
- Apr. 17-19—Southwest Conference and Electronic Show, Institute of Radio Engineers, Dallas Memorial Auditorium, Dallas, Tex.
- Apr. 17-19—Technical Meeting, Nuclear Materials for Space Applications, American Nuclear Society Technical Branch, Battelle Memorial Research Center, Ohio
- Apr. 22-23—Annual Meeting, National Astronomical Society, Amer. Astro., Washington, D.C.
- Apr. 22-24—Second Annual Space Flight Symposium, University of the Americas, Mexico City, in cooperation with NASA and UARC, Dallas, Tex.
- Apr. 23-24—Third Annual San Diego Seminar for Advanced Engineering, Del Webb Convention, San Diego, Calif.
- Apr. 24-26—Seventh Annual Technical Conference of Radio Engineers, San Diego, Calif.
- May 2—Reinforcement Conference, American Rocket Society and American Metal and Alloy, Los Angeles, Calif.
- May 3-5—Fifth National Symposium on Human Factors in Electronics, Institute of Radio Engineers, New York, N.Y., New Bridge Roads, Madison, D.C., Calif.
- May 7-9—Electronics Components Conference, Institute of Radio Engineers, West End Bridge Hotel, Washington.
- May 13-15—National Aerospace Electronics Conference, Institute of Radio Engineers, Dallas, Tex.
- May 13-17—Congressional Guard Flight Team's Second National Symposium on Air Transportation, Hyatt Regency Hotel, Cleveland, Ohio.
- May 20-22—National Symposium on Micro-wave Theory and Techniques, Institute of Radio Engineers, Munson Hotel, Santa Monica, Calif.
- May 22-23—Second Tokaimura Conference, Hyatt Hotel, Honolulu, Hawaii.
- May 23-25—Joint Computer Conference, Institute of Radio Engineers, Munson Hotel, Dallas, Tex.
- May 27-28—Second National Conference on Product Packaging & Protection, Institute of Radio Engineers, Continental Hotel, Newark, N.J.
- June 7-10—Sixth International Air Show, Le Bourget, Paris, France

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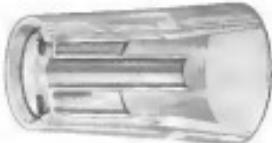
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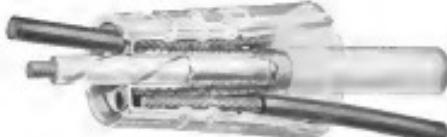
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DREI

New York, December.

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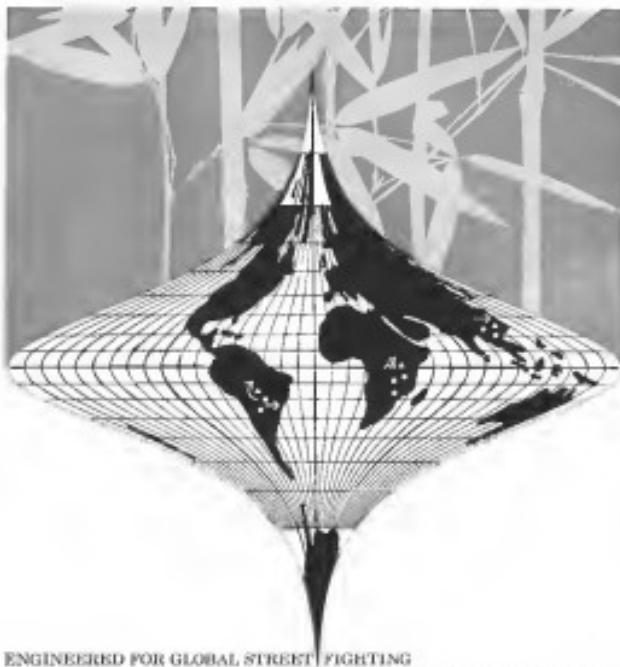
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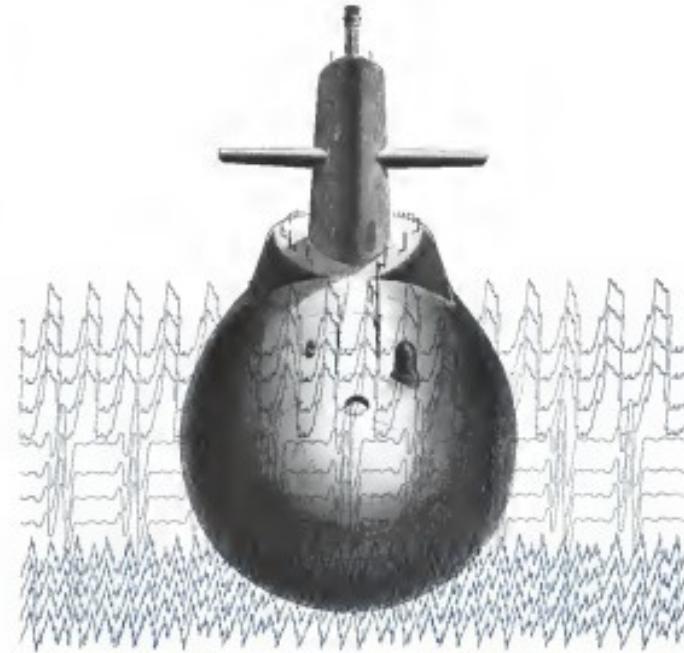
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DM Cells: Zelený *et al.* (2005) reported a higher rate of apoptosis in DM cells compared to control cells. This was attributed to increased ROS production in DM cells.

Aviation Week & Space Technology

Meyenius 26, 1992

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VICKERS
DESIGN AT SPEED AND CAPACITY

EDITORIAL

Progress on Cuba

Soviet agreement to remove all of their B-52 strategic bombers from Cuba marks another important toward the eventual solution of the problem posed by the Soviet attempt to establish a base for offensive nuclear weapons only 90 miles from the American. All Americans will certainly applaud President Kennedy's firmness in refusing to allow his ongoing demand that all types of offensive weapons be removed from Cuba by the Soviets and in continuing to insist on some type of authentic on-site inspection of the Cuban weapons bases.

Apparently all of the Soviet MRBVs (a slightly longer-range version of the earlier MIGs), have departed from Cuba ahead. Soviet freighters and the Ilyushin Beagles are scheduled to follow within 30 days. Both actions will help to reduce the potential effectiveness of the Cuban bombs, although the theory rests on the sole responsibility remains. The MiG-21 MIG-21 Fishbed fighters and the Cessna surface-to-air missiles still remain in Cuba, although there has been no further Grado Bay firing since one bright day in U-2 on a photo-recon mission Oct. 27. The Fishbed fighters continue to harass stragglers in Cuban air defense systems, but pose no real threat to a determined large-scale penetration of that island's air space.

Castro's Losing Struggle

It is interesting to note the sour grapes reaction by Field Castro to the forced departure of his IL-28 bombers. In his cited their obsolescence, slow speed and limited ceiling.

As we noted earlier (AW Nov. 12, p. 21) the IL-28 posed a real threat in the Caribbean area, Central America and in such Venezuela despite their lack of capability against the North American air defense system. Castro's reluctance to let them go is indicated by the lack of bargaining between himself and Soviet Deputy Defense Minister Mikayev before he bowed to the Russian's order.

This haggling over the IL-28 problem was also another measure of the U.S. determination to see the Cuban crisis through to its conclusion. The Soviets were obviously impressed by the speed and determination with which President Kennedy reacted to their Cuban missile grab, and there must still be considerable suspicion in the Kremlin as to whether the U.S. is really tough as it sounds. The U.S. rejection of oil compromise on the IL-28 removal must certainly have dissuaded some of these haggling doves both at home and abroad.

Progress on the Cuban issue, however substantial it may in fact be should not lull the American people and their allies into a feeling of false security on the overall problems of the Soviet-American confrontation. The sad sight of India today should be the stark object lesson against such on what health those who depend only on noble thoughts and sounding their own banza as a defense in this wicked world. Indian troops, when properly equipped and led, are among the world's finest fighting

men. But the spectacle of them marching up the Arun Valley in that tropical green carrying World War I vintage bolt action Lee-Evans rifles to do battle in the rugged Himalayan passes with Chinese troops armed with automatic weapons, machine guns and bows, mortars is a sad commentary on the wisdom of the leaders of this new nation. It has also taken great solace on the part of both Britain and the U.S.—both of which have been morally bound by leading Indian statements to their military might—in addition to a smattering "If never right at their rankled ordinary aid to India.

Despite the skillful Chinese propaganda barrage of proffered cease-fire, withdrawal and more often than appears that their offensive drive into India is an acute border dispute, but asked large scale aggression aimed at major strategic gains that could outlast both their Russian allies in the northwest and the SEATO pact nations is the fact. The Chinese are now extremely close in pouring into upper Assam and the broad Brahmaputra Valley. This was a strategic pincers sought vigorously by the Japanese during World War II and thwarted only by the way above Ingatong range of hospital. The Japanese were never able to subdue Ingatong, the sole shrubbing block on their open road to India. Because the surrounded defenders were successfully supplied and reinforced by air. Nearly 20 years later, similar to the Arun Valley, is again a critical factor in deciding which arms, strength or let us say, and maybe there are some lessons to be learned from that.

Airlift Foresight

One of the first military actions taken by the Kennedy Administration in 1961 was a program to strengthen military airlift, a considerable acquisition of Boeing C-135 jet transports and initiating development of the Lockheed C-141 jet freighter. The Boeing C-135s have already been doing valuable service, participating in three major emergency airlifts during the past year—in Canada, memo in the Cuban crisis, in typhoon-ridden China, and in the quick arm delivery to India. The C-141 is still under development, but the events of the past year have proved that it will be sorely needed when it is ready for service. In the meantime, the Lockheed C-130 continues to play a brilliant airlift role, performing well beyond the scope of its original mission.

It is certain that the wisdom of this early decision to broaden military airlift capability will be vindicated with the passing of each international crisis. At the pace world events move today, only airlift can react in time to be truly effective. However, the organization of the current and future airlift capability of the military services into an effective instrument of national policy, which provides maximum response to top priority problems at minimum cost and efficiency, is a problem as yet unsolved.

Cuba and India have certainly proved that it is hardly prudent for nations to stalk through the international jungles armed only with a high moral purpose.

—Robert Hora



New VTOL jet to work with the troops

The Army has long seen the need for a VTOL aircraft that can work within the environment of ground troops with high performance to perform jet-age observation and target acquisition missions.

The XV-4A, a research aircraft now being developed for the U.S. Army Materiel Command by Lockheed-Georgia, is this kind of craft.

The XV-4A uses augmented deflected exhaust from two turbojet engines to achieve vertical flight. Exhaust gases are augmented approximately 40 per cent by induction of outside air through doors that are opened at the top of the fuselage. For forward flight, these doors are closed, the thrust is directed aft, and the XV-4A accelerates up to high subsonic speeds.

LOCKHEED-GEORGIA COMPANY

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The Shrike is one of several variants of the family of Naval missiles now developed by the U.S. Naval Ordnance Test Station, China Lake, Calif., with engineering and manufacturing support provided by Texas Instruments Incorporated.

new war-club for nation's arsenal

The Navy's Shrike missile is the first of a new breed of weapons designed specifically to increase air-to-surface striking power. Shrike will provide a new attack capability against heavily defended tactical target areas, combined with increased protection for the Navy's pilots and aircraft under operational conditions. Texas Instruments is the prime contractor for the guidance and control sections of the Shrike missile, applying skills in electronics and aerodynamics. TI contributes to

the development of this high-performance weapon more than 20 years' experience in recognizing and solving tactical performance problems. ■ In addition to its systems management capabilities, TI possesses a unique combination of proved skills in many areas of endeavor. Expanding from a broad research base, TI leverages its various technologies to provide a continuous flow of improved products and services for its customers. Write Department J.

WHO'S WHERE

In the Front Office

George W. Leon, vice president and general manager, Strategic Weapons Product Division of Astrotronics, Denver, Colo., a division of North American Aviation Inc., succeeded S. Fredricks Krikken (AW Oct 22).

K. Robert Blaha, a company vice president, Leo Sanger, Inc., Mr. Blaha continues as president of the Power Equipment Division, Cleveland, Ohio.

Col. Langdon F. Atwell (USAF, ret.), as senior to the executive vice president, Aerospace-General Corp., Atlanta, Ga., Oct 15 (p. 23).

Honors and Elections

Robert E. Glavis, director of NASA's Mixed Propellant Center, has received the American Rocket Society's highest honor, the Robert H. Goddard Memorial Award, "for unusual contributions in the field of solid propellant rocket engines and the orbital flight record." Dr. John D. Obara also received the Dr. Col. John H. Glenn—Dr. ARS Astronautics Award for outstanding contributions to the advancement of space flight. ■ Mr. Hart is the first American to make an orbital flight at his own cost. Vice Adm. James F. Stockdale, Director, Naval Space Operations Special Projects Office; Col. James H. Wild, Meritorious Award "for outstanding application of nuclear power" in recognition of his lead role in the Polaris missile program and his contributions to the Nevada Test Site test programs. ■ Dr. Howard G. Harman, director of Research Division of North American Aviation—the ARS Propulsion Award for "outstanding achievement in the field of rocket propulsion systems." Dr. Howard S. Seltzer, Dr. Edward Franklin, Dr. John C. Nease, Jr., and Dr. Robert P. Freeman, heads of the Joint Physics Department of Electro-Optical Systems, were the ARS Research Award, given to the person who maintains a significant program of fundamental research in nuclear or ionization radiation, plasma or particle physics or in the interests of solid-state theory. ■ The ARS Space Sciences Award, to be presented annually in a selected area of achievement in investigation of the physics of the atmosphere or of celestial bodies. ■ Electron Devices of ASEA, Inc., of Falls Church, Va., received the Dr. Donald R. Ferguson, A. O. Trumbo and Walter G. Williams of NASA, Dr. Carl Paul D. Allison and Milton M. Shulsky of the Air Force Office of Scientific Research, Dr. Robert W. Bondurant and Robert F. Morris of the Naval Weapons Laboratory, and Dr. Ernest D. Gossen of General Dynamics Corporation of Aerospace, Frank J. Myers of the International Academy of Astronautics, Ronald F. Johnson of Massachusetts Institute of Technology, Mr. Guy Chouard, Dr. Richard M. USAF Systems Command's Space Systems Division, Mr. William L. Johnson, Mr. George C. L. Bishop, Dr. Lee Lofstrand and Space Co., Mr. Steve of General Electric Co., Harrison A. Shouse of North American Aviation, Harold Wiesler of the U.S. Weather Bureau, received a posthumous fellowship.

(Continued on page 181)

INDUSTRY OBSERVER

► Army has launched a development program at Raytheon to give the Hawk missile an antisatellite capability against short-range ballistic weapons similar to the Soviet Shyster MRBM recently removed from Cuba. By adding long-range acquisition radar and a high-speed computer to the present Hawk system of midcourse rest, Army believes the Hawk will do more damage against such threats. Army has demonstrated Hawk intercepts of targets and Segregated warheads under controlled conditions.

► Boeing Co. has approached British Soliddyke of Great Britain to obtain technical knowledge on intake and outlet nozzle geometry for supersonic transports in the March 2, 1972 stage. Boeing has made similar approaches to other companies which have developed specialized knowledge in supersonic transport technology to avoid duplication of previously done work.

► Evaluation of Navy's Bureau of Weapons for survivability has raised concern in some industry quarters that BuWeaps might preclude early risk reduction of construction mandates for all its avionics equipment within several years. But Navy officials say this is not likely, except perhaps in the field of airborne digital computers and the avionics system for the VAX fighter.

► Italian government is asking Fiat, Avio, Avialeo, Aviamilano Marche to submit proposals for a three-seat V-STOL transport for the country's air force. The aircraft would use Rolls-Royce RB162 lift engines for vertical flight and a General Electric CF700 jet/turboprop for horizontal flight.

► NASA's Taurus strategic satellite program will officially classified as an development plane, is moving rapidly toward operational status. Twisted navigation sensors are currently being installed in Pegasus missile-carrying vehicles.

► Thrust augmented Douglas Thor utilizing time delay-on Thrust XM33 Carter solid-propellant motors and topped by an Agni II stage probably will be test-fired early next year from Vandenberg AFB, Calif. The vehicle is being prepared for a dual fragmentation payload evaluation of the Thrusat 3 launch emergency boost of a variety of Discrete payloads of maximum standard weight or high-density orbits.

► RCA's Radar communications satellite is scheduled for launch Dec. 12 from Cape Canaveral. Hughes Systems (AW Aug. 20, p. 80) will be launched in February, and AT&T is undecided on whether it should schedule another Telsat or one additional Telstar; it, like other, seems to be useful before making from the Telstar 2 schedule.

► Scheme for using Lockheed's Navy-Amy XH-504 rigid-rotor helicopter with a stability of wings was being prepared by General Electric's Advanced Products Business, Ft. Worth, Tex. One plan involves incorporation of the company's Vtolon multi-bladed, folding main-type weapon. GE also has planned construction of a non-motorized, 20-ton, M48 Vtolon on Lockheed F-104 Starfighter.

► Space has a proposed Blue Scout booster to the Douglas Thor probably will start July 1968. The length of the first hypervelocity, flying-reentry test vehicle being built by McDonnell Corp. for USAF's Project Anet (AW Nov. 8, p. 38). Blue Scout will not develop the total thrust required to boost the Anet vehicle. Then to be used for the seven Anet boosters will be taken from those originally allotted to the Guidance space program development and later acquired by the U.S. Air Force. The Thor will have to be modified for the Anet mission, and there is a possibility that Space-General Corp.'s Alliant upper stage will be used for the Anet program.

► Israer is using an nuclear warhead dearming technique—methods for disarming ballistic weapons before detonation. Besides government-funded studies, some companies also are beginning to invest their own funds in this area.

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occupies just 2 cu ft of space. Memory capacity: 4096 36-bit words. All solid-state construction. Circuit modules sealed and encapsulated for high component density and maximum reliability. Easily maintained. Minimum skill required to operate. Partitions with metal partition equipment. Designed for desk top or rack mounting. PRINTER, code compatibility model available soon. Engineered from Librascope's 25 years experience in computer technology. Send for data

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Washington Roundup

Budget Complications

Budget cutbacks are expected to be the central fact of life in defense and space programs in the coming year. The Kennedy Administration already expects an 8% budget cut for fiscal 1963. Newer findings indicate "Nominal" Aerospace and Space Administration (now p. 20), and the extra cost of the Cuban and Indian crises threaten to push that even higher. The Administration feels an 11% budget cut will do the job. The fiscal 1964 budget, which is being put together now,

DOD's Dept. estimates, payload by the soldier under either explicit guidelines laid down by Secretary Robert McNamara, new total above \$35 billion-\$3 billion more than the total approved by Congress for fiscal 1963. It will take drastic action to cut it approach below that. Aerospace officials say they want to see savings especially in such areas as pilot transportation and transportation. Most likely targets for cuts are weapon systems that don't stand up well in cost-effectiveness studies.

No funds have been released for work on the new field-of-view North Atlantic Treaty Organization countries but my medium-range ballistic missiles in Western Europe should be based on ships in harbors instead of on land. Several countries, notably France, fear that land-based MRBMs would be difficult to control and would subject each nation to nuclear blackmail. The U.S., in turn, fears that such nations might feel compelled to use the missiles independently, and might start a world nuclear war.

Under Secretary of State George W. Ball told the eighth annual NATO parliamentary conference in Paris recently that "From a strictly military standpoint we do not feel that the alliance has an urgent need for a European nuclear umbrella. But should other NATO nations do this, we are ready to give serious consideration to the creation of a genuinely multinational MRBM force fully coordinated with the other defense forces of the NATO organization."

State Dept. sources report that this statement represents a policy shift, pointing out that nuclear warheads cannot be given to any nation without specific authorization from Congress. But department officials did say Ball's speech meant that, as West European integration increased, the U.S. intended to share more nuclear information with its allies.

Houston Space Post

NASA headquarters is sending out James C. Elam, director of space and electronics for Aeromotor Division of Ford Motor Co., as the postholder of aerospace scientist director of its Manned Spacecraft Center in Houston. Dr. Walter C. Williams has held the dual role of associate director and director of operations there. Williams would continue to hold the operations job. Some observers think the concern is moving space flights to his wade back, to the fact that Williams held both jobs at once, yielding top management and operations into a single channel.

Elam has been at Aeromotor since 1959. Before that he had been manager of Martin Co. aerospace and an executive vice-president of Avco Corp., the main

Ross Adams, C. E. Womble, assistant chief of naval operations for development and maintenance warfare expert, and last week took Ross' submarine warfare directorate. Womble's previous assignment was as chief of naval research and development. All four new powered jobs which normally are involved in warplane features. Second surfaced after the Navy had tracked them for long periods. One, traded in 15 hr. in a dormitory, stayed up for a day and a half, apparently because of mechanical trouble.

Soviet Laser Progress

Soviet Chairman Nikita Khrushchev recently demonstrated that interest in laser development reaches to the highest levels in the USSR. When W. E. Kaus, president of Washington Electron International Corp., visited with Khrushchev for three hours recently, the Soviet leader showed him a 6-in. steel ruler polished with two holes. Khrushchev said the holes had been drilled by laser beams. He said he knew the U.S. was working on long-time basis but was surprised by his leader's knowledge. He said he knew the U.S. had the early significant U.S. work on lasers in 1952. Kaus claims to have been working on lasers since 1951 but the U.S. knows little about Soviet progress since then.

Staples still doubts that Soviet MRBMs (medium-range ballistic missiles) and IRBMs (intermediate-range ballistic missiles) could have flown as far as Cuba as the Administration claimed. This has led to a new category—PRBMs or Partial Range, Ballistic Missiles.

—Washington Staff

NASA May Cut Agena From Gemini Plan

Rendezvous with scientific payload or piggy-back satellite considered as move to save money and time.

By Edward H. Kolome

Washington.—Elimination of the Agena D launch in Gemini rendezvous is under serious consideration by the National Aeronautics and Space Administration in its way to cut costs and have its two remaining flights of the second state flight program. The agency is studying the feasibility of leaving the Gemini spacecraft rendezvous with orbiting scientific payloads, or with satellites attached to Gemini and then ejected, as alternatives to the Agena D target.

This is the next significant of a number of studies programmed under way in NASA which are designed to take up the task in handing the Gemini space agency's experiments (AVW Nov. 12, p. 27; Nov. 19, p. 26). Most money is not appropriated because of Administrator James E. Webb's decision and his request supplemental

Several members of Congress are expected to urge Webb to consider his decision and ask for \$100 million in supplemental appropriations in January. This would provide extra defenses to insured space flight which now amounts to \$100 million, and \$100 million for Ranger, Surveyor, nuclear propellors and other announced programs which are entering into funding difficulties. The remaining \$10 million would be a contingency fund.

The budget commitment of the Gemini program, which NASA says depends on the Air Force to play an important role in development of the program, including USAF funds to buy Gemini instruments (AVW Nov. 5, p. 42) for Dual-Solar (LSB) crew training and for performing rendezvous.

USAFA would use the Gemini D stage in rendezvous development with Gemini, in which both targets and planes would be maneuverable. If NASA shifts to a target stage as a secondary satellite, and the Gemini spacecraft would be maneuverable. Contributions of the two partners would provide 60 percent to both cost and continue support until NASA hopes to decide within a few weeks whether to embark on the new program.

Gemini program (AVW July 1, p. 94) is designed basically to qualify rendezvous to prove for later use on the Apollo lunar orbit academic mission. Of the 17 flights planned on the schedule, eight include rendezvous and docking, one is a habitation mission and the other two are 14-day orbital missions.

The habitation flight which will be the first Gemini launch and the only one mounted version in the program, is one accelerated for November 1965, a four-month delay from the July schedule of earlier this year. Robert B. Chidester, director of the National Spacecraft Center, told the American Rocket So-

ciety he was approved at the top level. When approval is obtained, program managers will decide on the capsule which will carry personnel and biological specimens in orbit. Missions considered (AVW Aug. 13, p. 26) are the Stratoc-E 7 and Modular Microsatellite capsule.

An "Eros" which recently returned from the biological satellite returns to NASA (AVW Sept. 23, p. 26) has recommended a Lockheed-designed lidl for the mission, but NASA refused.

A "Gemini piggy-back satellite may be developed as the target. In this concept, the Gemini spacecraft would carry on board a light-weight payload which would be ejected off the plane of the Gemini capsule after it was in orbit. Otherwise there would be no Gemini option to practice various rendezvous techniques by approaching and docking with the orbiter.

A Soviet Titov 2 second stage was used as the target in the initial rendezvous studies.

The Gemini spacecraft is locked on not only in the track for Apollo crew positions and techniques, but also as the first operational U.S. maneuvered spacecraft because of its capability to maneuver and change orbital plane. It is anticipated that if NASA withdraws the Gemini mission, the new target will incorporate a docking port, radar transponder and horizon sensor. Agena D stage for the Gemini mission will be modified by addition of a collar arrangement into which the Gemini pilot would snap their spacecraft.

Gemini D funding for Gemini was \$4.2 million in fiscal 1962 and was to be \$21.9 million in fiscal 1963.

Radar Buster Missile

Proposed for a small, maneuverable anti-infiltration vehicle (MAV), or "radar buster," which might be launched from a submarine, ballistic missile or missile base on the condition of a ground-based radar lock onto an anti-B-52 system, may soon be held by USAF's Defense Systems Division.

India is among us, and joining the battle now. Many is interested in "radar buster" with the authors of the solar return and reentry involving its own program.

With statement by May was being proposed recently to Aerospace Corp.

Team Instruments Inc. based on work on a Boeing B-52 weapons anti-ground infiltration missile (AGM), which is associated to Marconi, Spain Technology Laboratories recently proposed to the Air Force its own solar return concept, known as "Whisper."



Nord Rolls Out Transall C-160 Cargo Transport

Nord Aviation C-160 Transall cargo transport has been rolled out at the Nord factory in Paris. Aircraft is scheduled to begin engine run shortly and to fly in late December. Second prototype of the joint Franco-German transport is being built at the Wiesbaden factory near Berlin and will fly next March. Third prototype is being built by Hawker Siddeley Farnborough at Slough, will fly in late 1963.

More Minutemen Sought to Replace B-52s

By Larry Brooks

Washington.—Planned fiscal of 1968 Air Force Boeing Minuteman intercept aircraft defense will be more than doubled to 1,700 by Defense Dept.'s fiscal 1967 budget request. The planned intercept aircraft, known from 1963 defense budget was being prepared by the Soviet Union, will consist of a large portion of the USSR's fleet of more than 700 B-52s, B-52 bombers.

The fate of the USAF Douglas Skyray air-to-air interceptor, also known as the baseline in fiscal 1967 USAF budget decisions are being determined in the office director under Defense Secretary Robert S. McNamara.

When the Air Force submitted its first program package for Minuteman in June of 1961, it proposed a total of 2,500 missiles to be placed in sites and estimated cost at \$6.5 billion per year. From fiscal 1962 to fiscal 1967 (AVW July 26, 1966, p. 49) the cost per site was cut to \$1.666 billion based on the fiscal 1963 budget sent to Congress. Congress approved a figure of \$600.

The present Defense Dept. plan

would cut off phasing of all of the

operational B-52s through B-52B in

cost over a three- to five-year period.

A total of 440 of these models were

predicted. Some have been destroyed

and others are in various test and spe-

cial mission programs. There are now

14 B-52 wings. Each wing has 15 sites

in the operating inventory and

sixteen spares.

This results for 720 aircraft.

The remainder of the 744 B-52s

predicted are in the inventory under

control.

But over the last of 1962 and

1963 aircraft are being deleted.

The 143 B-52s are being modified to solve

a fatigue problem and to carry the

New American Board Dog at low-light

missions.

In addition to the wing problems, the

C and H models must be equipped with

completely different guidance systems

for their respective missiles. In use is

point Heron Dog has an advantage over Skyray. It can be guided from the moment of launch and to carry Skyray.

To raise costs with current and existing aircraft of the service, Mc Namara has indicated that he stands by his intention to keep the B-52 in service. From 1963 defense budget was being prepared by the Soviet Union, will consist of a large portion of the USSR's fleet of more than 700 B-52s, B-52 bombers.

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With Skyray, however, the portion of the launching aircraft used to determine with great precision. The most important and accurate method for navigating aircraft is by star tracking. At night the B-52 aircraft can track two stars continuously. It was discovered recently that daytime star tracking which is as accurate as night tracking has been developed. Engineers of the defense secretary's office are depicted on this panel, however.

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The Skyray can be guided only during the day. Navigation standards and control for ballistic missiles is still being developed. It will be applied to long range first, not a small one like Skyray. Cost-effectiveness studies have posed the question: "Is it worth \$2.5 billion to finance the B-52B type of aircraft with the capability to deliver a payload of 4000 pounds with a yield of X minutes at distance point rather than 400 Minuteman missiles costing \$2 billion and delivering a much greater number of intercepts?"

Answers of the missile, their vulnerabilities and their reaction time are also considered in making a final decision. Minuteman is more likely to be long range, intercept, while the B-52 is short range. That is enough to cause many defense officials who have been convinced it will soon be spearheaded by sufficient numbers along with the Navy's submarine-launched Polaris missiles; that the baseline force can be doubled over the next five years.



Space lighter vehicle, later stage of a series of studies made by the Martin Co. between 1958 and 1962, shows current thinking on designs for resupply and support of orbiting space stations. (See page 22 for other, earlier details.)

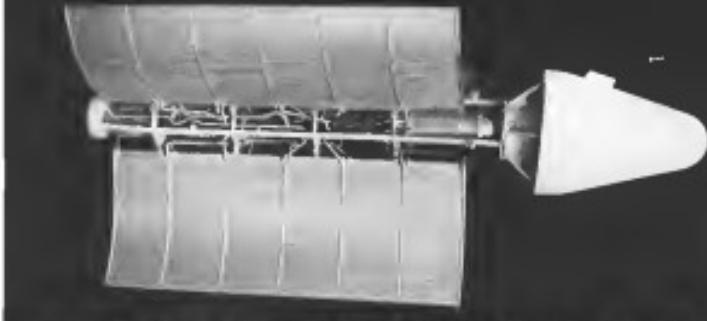
Aerospace Companies Display Advanced Designs



Hercules Powder Co. used a filament wound casting (above left) for a 100-in. dia. solid fuel rocket developed for the National Rocket Society in Las Vegas (AW Nov. 19, p. 27). Solid burning solid fuel is the fuel for interstage engines (above right) developed at Rocket Research Corp. Thread diameter is 0.01 in., thrust a short arc to 100,000 lb.



Douglas-McDonnell rocket body (left), developed by General Electric, is simple conical shape with hemispherical nose. Small solid engines are attached to base of the body, propulsive fins for spin-stabilization of the stage during reentry, to reduce dispersion. Test vehicle for NASA Zuma (arrow from right) is one of several being developed by GE's Research Center Dept.



Nuclear rocket powerplant for space vehicles, currently considered as one means of providing large quantities of electric power in space, is shown in this conceptual model by Curtiss-Wright Aircraft Division of United Aircraft Corp.

Of Powerplants, Probes, Logistics Vehicle

Chemically NERVA rocket (below left), developed by Atomic Energy Corp., indicates the size of the fuel unit planned for upper class testing in the Rahl vehicle. Martin Pegasus (below right) a three- or four-stage high altitude probe developed from the company's Pending satellite program, is detailed in this cutaway model. Front detail of the Pegasus were revealed in Aviation Week (AW Nov. 18, p. 27).



SA-4 Engine Will Be Shut Down In Flight to Test Rocket's Stability

By George Akerside

Huntsville, Ala.—Marshall Space Flight Center plans to shut down one of the eight Saturn C-1 booster engines during the launch vehicle's next test flight-Nov. 10—initially scheduled for April 1963—but for the engine-out performance of the propellant and flight control systems and the effect of fuel being lost due to heating.

Principals think the two National Aeronautics and Space Administration center engineers will be shutdown of one of the C-1 four-nozzle engines about 30 sec before burnout of the booster which will be designated SA-4. It shall bring down one engine and resulting or actual failure, Marshall engineers hope to test the abilities of the composite propellants system. Propellants that normally would be consumed in the dead engine should be transferred to the other seven powerplants to extend their burning time and to compensate for the loss of one engine's thrust.

Schism of an oxidized casting also could test the ability of the flight control system to respond to propellant motion to correct the position of one engine. The four nozzled engine of the C-1 can be ignited ± 7 deg to provide pitch, roll and yaw corrections; the four internal engines are ignited slightly around and are held fixed.

Also of major interest to Marshall engineers will be the effect of one dead engine on heat heating. Engineers gain all eight engines tend to form it in isolating them from the glass fiber shell which protects the base of the tankage. Loss of one engine's exhaust will allow some backflow of the other seven to give exhaust to the heat shield and up to 100 deg. But last year, Marshall engineers are anxious to know if the shield can withstand the possibly severe localized heating.

Principals, after much indecision, felt the third flight test of the eight engine Saturn, SA-3, Nov. 10, was too risky as its two predecessors, SA-1 on Oct. 27, 1961, and SA-2 on Apr. 30, of this year. Liftoff occurred after a 45 min hold caused by a faulty ground generator.

Hybrid engines of SA-3 lagged for 14 sec and the four external for 149 sec. Unlike SA-1 and SA-2, which were then about half burned and outward above a supposed fire propagation level had fallen below a level sense in the tankage, SA-3's exhaust was shot down by the igniter but its nozzles were allowed to run until automatic shut-

down because of propellant depth but

then the tankage level descended as SA-3's remaining propellants that ignited a separation which commanded shutdown of the four nozzles about 110 m above after initial detonation. On SA-1 and SA-2, the burn then continued after shutdown of the four nozzles as igniter failed. On SA-3, however, the remaining four nozzles burnt the exhaust until the igniter detonated. It took a second of the detonation's duration for the four nozzles to ignite. Thus, thrust like switches are forcedly restored; an overall all engine system with the exception of much combustion and fuel depletion—would be dictated by three units at a pressure drop. Decrease of a pressure drop of more than 10% of sea level thrust would terminate that drop.

Under this new procedure, the four outward engines remained in task as propellants built up ignition in the liquid oxygen propellant system. This caused a pressure drop of approximately 10% of thrust which the tankage-and-igniter system detected. External engine igniter detected the pressure drop and with all that information, then on its own, commanded shutdown of the other four nozzles. That shutdown procedure which

Minuteman Troubles

Cape Canaveral, Fla.—Missile and solid propellant ballistic missile code a success 5,330 km flight down the Atlantic Missile Range Nov. 29 after trouble with the Antireturn-heat guidance system had postponed all but three of the weapon system's five tests this summer. Control panel problems, short-circuits in the guidance electronics and digital computers were the source of the guidance system's difficulties.

After Minuteman 422 failed to re-

turn during reentry from the initial ascent after liftoff from Site 300 Oct. 17 (AW Nov. 12, p. 36) it was delayed for the range safety officer and USAF promptly suspended all further flights until the trouble was traced and corrected.

Johnsons, along with Boeing and Space Technology Laboratories, ran an extensive series of tests at the Andover, Calif., plant on both operational and research and development guidance system issues of the system soon appeared to come from research and development in structural stress. Antireturn resulted in early guidance out and stopped it in USAF labs for the Minuteman flight

Marshall engineers said operational anomalies in SA-3 was to be met again on SA-4. It will not be for the flight of SA-5, the first of the C-1 Block-2 vehicles (AW July 2, p. 17), because the SA-1 second stage will be flown live for the first time on that vehicle and there are special cold start procedures which must be run on the SA-4's RL-10A3 hybrid hydrogen engines just prior to second stage ignition.

The timing of these shutdowns may endear it important and in Marshall program officials will resort to a bear to ensure that the four of the SA-1 first stage engines are shutdown in sequence. The SA-1 and SA-2 should just wait until the propellant load method of shutdown allows the SA-1 igniters will be shutdown on SA-3.

Marshall telemetry and instrumentation equipment received two unexpected windsills from SA-3. The first burn was the result of an unpredictable roll of long duration which developed in the vehicle toward the end of powered flight. The roll, which was damped to a "perfect roll or roll" without any associated pitch or yaw motion, gave ground stations the opportunity to determine the propagation pattern of the vehicle's 27 antennas. Theoretical models were used to approximate such observations.

The second burn was the discovery that the telemetry link continued to modulate after the deliberate destruction of SA-3 for Project Highwater (AW Nov. 19, p. 34). The transmitters were housed in a container mounted at the forward end of the SA-1 stage. Analysis of the post-explosion transmission is expected to provide information about the nature and direction of the big twisted wires.

Two new telemetry links carried by SA-3—one a pulse-code-modulated (PCM) and the other an ultra-high-frequency (UHF) transmitter—were reported to have been destroyed automatically, although UHF transmitters were more PCM system was one of the five links to continue operating after the Highwater explosion.

Ballistics, another C-1 Block-2 experiment (AW Nov. 18, p. 36), was fired at about T-152 sec and burned normally for about two seconds. During this short period, the impulse frequency-modulated (PFM) telemetry sensors in the 330 (360) m line had experienced about a 10 dB attenuation. On SA-4, Marshall program officials plan to install a tape recorder built to store the attenuated data for later playback and to store data that normally would be transmitted when the Saturn vehicle is not in an optimum point in its trajectory. No other instruments in ground control, also. Although SA-4 will be a General Electric Co. Motoren transponder and radar reflector.

Kennedy to Review News Policy; Defends Cuban Crisis Crackdown

Washington—President Kennedy last week planned to review his administration's news policies during the Cuban crisis to determine if they "are being used in a way consistent with the fact flow of news."

The President and his law enforcement agents for the tight clasp on information during the length of the Cuban entente, however, "would have been a great mistake and possibly a disaster" if details of the Administration's blockade plan "had been disclosed out west while we were aware of the extent of the Soviet buildup in Cuba, and when we were aware of our responsibilities and what we had committed with one of our allies, who might thus

acts have been involved in great difficulty as a result of our action."

However, President Kennedy added,

of the precedents which have been set up, which are really to protect the interest and security of the United States, are being used in a way similar to the free flow of news, then no world crisis

will ever

occur.

The information committee, established earlier by Secretary of Defense Robert S. McNamara, assistant secretary of state for the Bureau of Public Affairs, requiring departmental explosives to report their existence with resources. On Oct. 27, McNamara directed "all Department of Defense personnel in the Washington area" to restrict the flow of essential news at the Pentagon. If it did not work, he said, "I have no choice but to change that."

The President and his "would be enlightened" to talk with Arthur Schlesinger, assistant secretary of defense, his policy advisers and members of his staff, "if we can get this straightened out so that the

public flow of news to which the press is entitled, and which I think ought to be in the press and in which an Administration really must depend as a check to its own actions." He said sensitive information has gone out of the Pentagon in the past which "can affect national security and potential aggression has been extremely unusual to the interests of the United States."

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USSR Agrees to Remove IL-28 From Cuba

Washington—U.S. last week lifted an air blockade of Cuba after Soviet Chairman Nikita Khrushchev advised President Kennedy that all Russian-built IL-28 bomber aircraft "will be off the air" in 30 days.

The President indicated his initial insistence on an indefinite ban on offensive weapons have been removed and until the U.S. is assured that they will not be re-introduced.

Although the blockade has been off 30 days and 200,000 men were deployed, Moscow ordered its aircraft to withdraw from Cuba peacefully with Limited PRCV to photograph the island and check the number of IL-28s.

The President and the Soviet government "has stated that all nuclear weapons have been withdrawn from Cuba and all offensive weapons will be withdrawn," he said. "The importance of our continued vigilance is underlined by our identification to our ships of a number of Soviet ground combat units in Cuba, although we now understand that these other Soviet units were associated with the presence of offensive weapons and not with the withdrawal of those units."

There appears to be no chance the Soviets will re-introduce nuclear weapons to Cuba unless they do so in due course.

Several sources informed Khrushchev and President Kennedy since their coded exchange of letters ending Oct. 28, 400 hrs, aimed at exploring the U.S. definition of "offensive weapons" and at clarifying the IL-28 and verification questions, the President and Soviet officials agreed to the following:

Both believe U.S. and Soviet officials at the United Nations were credited with contributing to the Hanoi agreement, but the President did not mention Cuban Prime Minister Castro after "he" in UN. Soviet General U. D. Gagarin, who wrote to Castro that Cuba would not move in the way of removal of the Bolivian "but that it possesses a legitimate and indisputable right to defend its borders against [U.S.] encroachment" and it regards the warning that "in the interest of the sovereignty of our independent weapons may well threaten which creates Cuban interests to do so only at the risk of being destroyed."

Castro and Gagarin "warning in their limited speech and low flying calling [the IL-28] an important organization in relation to nuclear issues of self-defense defense." He did not repeat his frequent demand that the U.S. withdraw from Guantánamo Bay.

President Kennedy made no pledge not to invade Cuba. His negotiations have not been completed and that "does not offend" him. "There will be peace in the Caribbean" if "all offensive weapons are removed from Cuba and kept out of the hemisphere in the future, while absolute verification and safeguards, and if Cuba is not used for the report of aggressive communist purpose," he said.

Intelligence at sea has confirmed "that the number of missiles reported by the Soviet Union is being very brought into Cuba, which clearly corresponded to our own information, but was never clarified," the President said (AW Nov. 19, p. 38).

First Nimbus Launch Expected in Late 1963

Washington—Another weather satellite, communications testing should be completed by mid-1963 with the first launch of the 703B payload scheduled for late next year according to NASA.

Space agency officials told 250 government and industry managers attending a November meeting of the Government-Civil V. Space Panel, that NASA and GE are now nearing completion of the first of space communications satellite—the CE-1 preflight orbiter. Verification and validation tests have been completed and tests of the control system are under way.

Nimbus is the second-generation U.S. weather satellite, and it is being developed in GE under management of NASA's Goddard Flight Center. It will be launched onto a 500 km polar orbit in a Thor-Agena B vehicle from the Pacific Missile Range.



New Photos Show Russian Naval, Shyster Missiles

Russian naval missiles and audience are clearly seen in these photos of the Russian missile which survived in the airshow at the Nov. 7 Red Army's military parade (IAW No. 32, p. 29). The three-stage missile, described as capable of being launched from a launcher, has a blunt nose shape that may be a heat shield to absorb reentry body heat as it re-enters covered with ablative material. Cluster of seven exhaust nozzles at the tail



New and older versions of Shyster appeared in the parade. New version (above) is designated S-100, has fixed fins, simplified framing for piersing and open front finbox at the nose on the lower points instead of a flat finbox. Note similarity of low profile to the one used for the naval missile. Both are fitted with heavy solid fuels for launching the forward end, indicating it may play some

role in missile guidance as well. Transporter for the S-100 has seven truss bays instead of six seen in most other photos of Shyster (IAW No. 5, p. 34) and the S-100 is estimated to be approximately 30 ft long, longer than the Shyster, and larger in diameter. Transporter below has cranes and off roadway and some of the nose area.



role of a solid-fueled rocket cluster with fuel at the top during the climb. Another possibility is that the nosebox and aft section, which drops off at the point of the off-trail maneuver, may contain a propellant or block powder for firing the nose cone after the warhead has separated. Such a technique would require protection of the relatively fragile rocket engine nozzle afforded by the air suction here. Protection at the off and end

ends of the vented tanks may be lifting ports or jet at points where they meet. There are numerous small fins, indicating they may rotate. Transporter has a pair of wheels and is extremely strong in appearance. The Shyster mobile transporter (IAW No. 10) below. Wings at bottom of the two upper stages are notched and may serve for adding weight in an emergency. Length of missile is 45-50 ft, and diameter of the first stage at 6-7 ft.

B-70 Flight Delay Due To Electrolytic Action

Washington—Electrolytic action by liquid salts of dissimilar construction in engines and stages cause and destroy aircraft structures. Engineers are now concentrating on solving the same problem as applied to various components of the aircraft.

B-70 engineers are studying the cause and testing dates from the early 1950s, while the electrolytic attack from the mid and late 1950s. Defense engineers said that if such an aircraft were de-signd from the technology of 1958, the aerodynamic configuration would be about the same. The redesign would be considerably changed and the engines would be turbines instead of propellers.

The B-70 was designed to include extensive use of steel in its unique complex fuel system of component parts and their reaction to physical changes in the aircraft's internal areas. But it was not until the mid-1950s that the role of the electric surface layer that contains imperceptibly large to spacer human surfaces of dissimilar metals.

This corrosion was due directly to electrons in electrically active metals which developed at the points where different metals touched. The dissimilar metal components of the aircraft's electrical system in the process of motor vaporization and other catalytic substances reacted with the metals to produce a scale and pits.

This reaction became severe enough to cause fuel tank leakage when the aircraft was subjected to the extreme temperatures that will be experienced in March 5 flight at the same time being heated at 10 ft height. High temperatures accelerated the chemical reaction.

and the aircraft would be

Manufacturers have solved similar problems involving metal-to-metal contact in engines and stages and also in aircraft structures. Engineers are now concentrating on solving the same problem as applied to various components of the aircraft.

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Lunar Base Supply

NASA's Manned Spacecraft Center has completed an in-house analysis of requirements for supplying a base on the moon by 1980. Logistics studies conducted by NASA will accommodate requirements for a man-made oxygen and hydrogen source and for a base 2,000 ft in depth.

Apollo spacecraft currently could be used for this mission, but it would have to be modified extensively.

One logistic feature studied in NASA includes a 200- to 250-ft tall solid-propellant motor for the first stage. 150-ft tall solid fuel second stage; 125-ft tall spherical solid motor for third stage and a liquid-propellant fourth stage housing mobile fuel.

Army Ends AN/USD-5 Surveillance Drone

Air Force will terminate its AN/USD-5 surveillance drone program. System was being developed by Fairchild Space Corp., Hagerstown, Md.

Army procurement study of the program, Defense Dept. said, had determined that the USD-5 was feasible but that it would be too expensive for procurement in the quantities Army needed for an effective surveillance capability. Army will depend on the Ma-5A local observation aircraft and the USD-2 drone system for future all-weather combat reconnaissance needs.

Earlier this month, Fairchild announced receipt of a \$9 million follow-on contract from Army for reliability and test flight development of the drone through fiscal 1970. See p. 1230.

Termination of the program at this point is expected to save about \$50 million for application to acquisition and development of higher priority systems. Army officials said Army will receive a cash refund of about \$4 million from the relatively contract. Cost of the program, beyond the test flight development, apparently involves projections, however, since no production contract commitment had been made.

Report of the program termination as Fairchild was not immediately determined, but 400 persons, mostly research and development, were involved in it. This represents about one-fourth of the company's total employment. About 20 test flights had been made this year with successful results.

Federal Mediators Hope to Avert Strike at Two Lockheed Divisions

By Katherine Johnson

Washington—Effort to avert a strike at two divisions of Lockheed Corp.—Lockheed California Co. and Lockheed Missiles and Space Co.—was made last week by Federal Mediators and Conciliation Service.

Following a 10-day membership vote by workers of International Assn. of Machinists to strike Wednesdays, Nov. 25, the mediation service arranged a meeting of company and union representatives with two of its commissioners, Ralph Peterson and Gisela

Hughes. The union shop—the most contentious issue in the agreement-labor deadlock—negotiations which had been in progress for several months and led to the strike action (IAW Nov. 19, p. 46).

The company, inclined to prevent a union shop in its plants, had appointed a panel of three to advise the board appointed by the President to advise on any strike, stoppage. The board, headed by Dr. George T. Taylor, proposed that a two-thirds vote of the membership be required to establish the union shop.

At their first, the union has failed to

win the necessary vote. Those are North American Aviation, Inc., and Ryan Aircraft Co., both organized by Armed Air Workers, and the Com. Div. of General Dynamics Corp., represented by IAM. Boeing Co. has agreed to a vote by its IAM members early in December (IAW Nov. 12, p. 17). Lockheed also turned down a union proposal to submit the same shop vote to arbitration.

Defense Dept., in its public statement on the union shop, threatened to cut off the pay of strike leaders and to ban them from Lockheed, in the event of a work stoppage.

The missile company is producing the Thor missile built inside the Space Transportation satellite, the Midas missile carrying cameras, and the Agency's space station. Congress also has IAM workers at missile sites at Cape Canaveral, Vandenberg, AB, Santa Cruz, and Homestead.

The major producer of the California company is the F-104 Super Star fighter and F/A-18 Hornet ASW aircraft.

Defense Dept. said that the two unions and all aerospace companies except Lockheed had accepted the joint DOD-Boeing conciliation plan.

Lockheed stands alone or refusing to follow the course that the other members of the industry considered reasonable. The President in his press conference on Sept. 15 pointed out, following acceptance of the Taylor Board proposal by the unions involved, that the responsibility for any strike that might take place in this industry would be clear in the dissenting people.

"Should a strike take place at Lockheed, Defense Dept. programs of critical urgency in the national defense would be affected," it is reported in the network service. It is believed that the Dept. of Defense will necessary programs be continued to the greatest extent possible, "with the prospect that negotiations for a new contract might end in a work stoppage." Respondents outside of the Dept. of Defense are therefore considering whether alternate means of production can be utilized so that work as these vital programs can go forward in the event of a stoppage at Lockheed.

Lockheed management viewed the Defense Dept. statement as "an appeal to both the company and the unions." The company called the strike action "an attempt to force companies such as Lockheed and partners of whom does not have 14,000 engineers who have to leave the plant." The company is a member with IAM and AFMPC.

On Nov. 13, a month ago, the company stopped out of its factory because of Company-wide lockout.

Building trades unions engaged in muscle meat contract, indicated that such work they would obtain, IAM pact last week.

BAC Plans New Entry in STOL Competition

London—British Aircraft Corp. has designed a lighter low-sophisticated aircraft short-takeoff and landing (STOL) airplane than its BAC 206 to compete alongside in the Royal Air Force (RAF) requirement to replace the Shortsleeve Breda-Bacino (IAW Sept. 10, p. 30).

Proposed design calls for use of four Relia-Brite Spey 103 engines featuring deflected ducts vis-a-vis the exhaust ducts to provide the STOL aircraft (IAW Sept. 14, p. 14). A potential follow-on review for revised takeoff and landing (VTLR) probably calls for package Rolls-Royce turboprop engines.

BAC previously had selected the BAC 206, using the more powerful Bristol Siddeley Pegasus deferred-thrust engine. This engine is competing with the Gnome-Rhone 14B-100, proposed by the Reggiane, and STEL version of the Short 360 transport. The latter is based on the Cessna 441 with boundary-layer control, which will be built in Italy under license. British Aircraft Corp. is involved.

Discussions are dropping. The most recent requirement is going along with the replacement of a rear variable propulsive nozzle by British Aerospace' tendency to spend on \$10-million in development costs.

However, Minister of Aviation John Amery, will be in Parliament for a program report on Oct. 31. He will be asked to report Ministry progress on the Anglo-French Concorde supersonic transport (IAW Nov. 19, p. 46) and the possibility for an RAF Royal Navy entry for the Hawker P.1127 V/STOL fighter.

Russia Claims Mark For Free Fall Jump

Moscow—Prestigious jump from 34,000 ft is claimed to be the highest ever achieved by a civilian daredevil. The President of the Soviet Union, Leonid Brezhnev, claims USAF Capt. Joseph W. Kittinger fell 34,000 ft on Aug. 16, 1960, and used a stabilizing chute.

The Soviet Defense Ministry newspaper Krasnaya Zvezda said Major Valentin N. Andreyev, at the time second Lt. in a jump from the cockpit of the Vostok billion-tonner, was the first to break the Vostok record in the Soviet area.

Capt. Peter J. Dugan, a developer and test paratrooper, question whether Vostok's achievement can be declared as a record from the same position when it reached 34,000 ft, apparently opened his chute when he stepped out, and landed in the desert, the Soviets say (IAW Nov. 12, p. 36). No cause of death was given. Maj. Andreyev and

the temperature when he jumped was -79°.

The ten Maj. Andreyev's 1,310-ft parachute jump. He holds six national records in single and tandem jumps and four of those are world records. Andreyev is 36.

The Vostok took 2 hr and 28 min to ascend. Maj. Andreyev jumped at 19,100 ft, landed at 12,224 ft. He fell for 13,000 ft, 20,000 ft, with his back, down to land on the steppes of West Siberian Federal Front. Landing, he used both main and earned harnesses to assist him to provide power for the rest, and was blindfold in case of water landing.

Maj. Andreyev and his son, now 20, jump solo with an orange flame along the horizon and enormous bright star as he fell. After falling, he found a small fire, ate some bread and reached a speed of about 50 mph. Maj. Andreyev started his descent at 19,100 ft, apparently opened his chute when he stepped out, and landed in the desert, the Soviets say (IAW Nov. 12, p. 36). No cause of death was given. Maj. Andreyev and

Polaris A3 Failures

Cape Canaveral, Fla.: Failed in an attempt to test for the Lockheed Polaris A3 submarine-launched solid propellant missile occurred here Nov. 17 when the second stage malfunctioned after separation.

After boost, and second-stage ignition, the missile recovered in the first, the first and third stages and in each one the problem was detected. In the fourth test, the first stage had functioned.

Reactor controllers for the A3 first stage diagnosed the theory that a hydrogen leak was caused to keep a pump from operating and blanking out during the flight.

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News Digest

British government last week up-graded funding for development of an advanced version of the Bally Bowes 300 incorporating a new wing, and designated Spey RB.167.25 (IAW Dec. 15, p. 23).

India has purchased eight de Havilland Vampire jet fighters from Britain to help offset India's lack of jet aircraft.

United Technologies Corp., a wholly owned subsidiary of United Aircraft Corp. will become United Technologies Const., an operating division of UTC on Dec. 1. Manning has been voted to appear before the new const.

Acquisition of Trans International Airlines by the Sheldene Corp. has been completed following a recent CAB order disallowing participation over interlocking arrangements that have resulted from the purchase.

United Air Lines filed for federal court injunction at Chicago last week to block refund by some of its planes to proceed with training for jet bookings on Oct. 20, ending 100 rentals.

General Atomics Engineering Corp., source of the Joint Contract research transportation, has opened a trans office at El Segundo near the NASA Marine Spacecraft Center. Ted Ross is manager of the office, located at 7015 Gulf Freeway.

Four Navy officers in an altitude chamber were killed Nov. 15, when an electrical spark, involving all four, in the chamber near the end of a 14-day experiment at the Naval Air Warfare Laboratory in Philadelphia. Delays came when some part of a circuit became overheated, forcing a power cut-off. The four officers had been in the chamber for 14 days at simulated high altitude.

New NASA Position

Washington—Walter P. Bonne, a former Naval officer, has been appointed to the newly created post of deputy administrator for science data systems at the National Aeronautics and Space Administration. He will function as the center point between NASA and the Defense Dept. during Dec. 1.

NASA's new appointment will continue the lineage begun by Dr. Melvin O. B. Bilezikian, deputy director of the US Naval Systems Command for Manned Space Flight who continues after him in NASA.

Mr. Bonne joined NASA in 1960 and has been a member of the McDonnell Air Craft Corp. advisory council since three



Grumman's LEM Model Displayed

First photo of scale model of Grumman's Lunar excursion module for the Apollo-Soyuz Test Project shown above (IAW Nov. 12, p. 32). Vehicle will stand 17 ft. High-Leg and airbrush will resemble the most likely LEM module and be docked with existing Apollo command module (IAW Sept. 24, p. 32). Note reaction jet nozzles on side and front. Photo was taken in a studio; reflective tape and roll marks are studio parts.

AIR TRANSPORT

Foreign Flag Shifts Stall U.S. Air Policy

Changing composition of competition, particularly in Europe and South America, delay firm position.

By L. L. Doty

Washington—Chief obstacle to a firm U.S. policy on international air transportation is the changing composition of foreign air carriers' competition, particularly in Europe and South America.

In the original White House study on international air transportation (AW Oct 27 p 49), little attention was paid to the effect on U.S. regulation of shifts moves in the consolidation of long-range European carriers into an Air Union. Meanwhile, two more European airways—Scandinavian Airlines System and KLM Royal Dutch Airlines—have won recent financial difficulties and management problems which threaten to lower major operators in their competitive position.

In Latin America, a proposed plan to profit international operations of flag carriers representing Argentina, Brazil, Colombia, Mexico and Venezuela is under study. Although the plan is meeting some resistance, particularly from Argentina and Colombia, there is a strong possibility that such form of co-ordinated airline operation will soon emerge.

Whether the full impact of these changes has been weighed carefully by the White House steering committee, which is responsible for formulating a final proposed policy, is not yet known. However, it is clear at present that the composition of foreign and well-established differences within the steering committee may result in a retarding effect on policy, or worse, that generalists often take a specific stand.

A group of three may have been working initially toward such a stand, as the White House in attempt to postpone till Dec. 15 an acceptable draft based on the original study. Top White House officials reportedly want to pursue a policy in President Kennedy or, if necessary, that date at least that the policy can be included in the President's State of Union address early next year.

At present, it appears that any policy seriously considered will consist of a series of compromises reached in efforts to close dissenting units. This is how the various agencies and departments worked on the steering committee represented on the steering committee now stand with respect to the policy:

• Budget Bureau has taken a liberal position. It favors lower fares and a free exchange of traffic rights between the United States and the foreign flag carriers.

• State Dept. also tends to be liberal

staging initially, it will be considered as a pooling operation with each of the four carriers continuing schedules and providing services according to traffic volume. In the second stage, each of the four carriers will retain their individual identity but they will operate as a single airline. In the third and final phase, identity of the four airlines will be dropped and Air Union will be, in fact and in name, a single airline in connection representing four nations.

That Air Union will come as a monopoly, The Economic Board is not insistent in its concept, but is being held as the principle of final acceptance by some board.

The German government, for example, will have a choice of purchasing a German-made Volkswagen automobile or an Hispano-Suiza, driving Fiat car.

At present, neither the four countries represented by Air Union nor have any actual stage since Air Union is fully operative in its final phase. Circumstances, including those of the U.S.-Pan American and TWA, would be dictated the right to operate scheduled flights between points within the four nation because of shortage.

Cabinets in the international law body probably will accept the concept of U.S. nation as national carrier and interpretation by granting additional rights to foreign flag carriers' operations.

• Commerce Dept. takes the extreme conservative view, rating the strength of each of the regional chapters of U.S. airlines as a major goal.

Thus, it now appears evident that the U.S. will adopt a policy sufficiently strong to cope with increasing competition in one way, but a flexible enough with valid changes in the form of that competition.

Concerning action in European airline circles, as Air Union, the grouping of Alitalia, Air France, Lufthansa, Sabena, etc., all but an established fact.

Meanwhile, the future of KLM and SAS is unclear, but far along a line where some major change in the competitive completeness of these two carriers can be expected.

An analysis of Air Union gives some clue to the effect as follows: It will affect all U.S. international carriers. To begin with, the concept of Air Union is contrary to the concept of the European Common Market.

An Union will be formed of three

carriers, one of whom, KLM, is not a member of the European Common Market. The formation of Air Union will require the negotiation of a new bilateral and undoubtedly the signed contract will still require ratification at points within the U.S. to serve the four separate carriers.

Putting this, it is highly probable that Air Union will lean on the principle of simplicity and insist that it be admitted to serve as one, national party within the U.S. and U.S. carriers serve within Air Union's region.

Opposed White House study found that relations between the U.S. and foreign carriers in the field of aircraft leasing arrangements should be based on purely economic considerations. Some political implications for foreign firms in regard to negotiating with a monopolistic carrier, it was felt, would be difficult to envision in connection with

foreign firms to remain in consider-

ation. In fact, the U.S. has shown it is most reluctant to force political control actions into negotiations if such a move will serve U.S. foreign policy. In August 1963 (AW Aug 14, 1963, p. 25) the U.S. and Russia had agreed upon and ratified a bilateral agreement covering a zone between Moscow and Niag. Volga.

The agreement was to concern economic contact and to various exchanges made the technical aspects of airline operations. The document contains a partial list of six political documents. However, the conclusion of the so-called East and West Berlin is the Soviet Union caused the U.S. to drop the agreement on grounds that it could not grant Soviet economic rights in a time when political relationships were strained.

Meanwhile, several sources say, the U.S. is toward developing an interim stage agreement as follows: That is, the U.S. will grant some rights to the use of its carriers to carry traffic to and from a second nation. At present, there is no international conference, entering negotiations, and thus, no formalized code of mutual rights.

The international accepted "face" of the case does not apply to the air. Attempts to reach an agreement calling for free rights at international airports failed at the Chicago Conference on Air Transportation in 1944 and an effort to develop such an agreement has been made since.

Early last year, L. H. Shostakian of KLM, in a paper presented to the International Air Transport Association, in Paris, that the possibility of a world-wide system for the exchange of traffic rights in international civil aviation be explored.

ATA pointed out that most of the territorial and route control rules must be removed, not destroyed, for such a system. "Without some form of regulation there is the chance of an arms race," the paper said.

In its reply, ATA was generally in agreement as most of the major issues used, but failed to oppose ATCA's proposal for more controls. ATA also felt the portion that its instant program for the ratification of new rules should be adequate to ultimate worth of the present traffic control problem.

ATCA said it was not in complete agreement with the first point, FAA Administrator Nagel E. Habib. The association did not feel that expansion of compensation of excess and deficit rates the little before Congress during next session is appropriate strategy.

ATA presented view of procurement

ATCA To Carry Traffic Control Arguments With FAA to Congress

By Robert H. Cook

of control over traffic that was too restrictive, and development programs to produce a moderate organization.

Further data as accepting expanded cabin coverage as a license of traffic control would be "uncontrollable." ATCA emphasized a urging immediate adoption of the following recommendations:

* Technical analysis of rules needed to provide safe functioning of all flights down to 14,500 ft altitude. Military restrictions that are not suitable should be removed from the program, which should be free of any "political poison." FAA has suggested three very long-range trials in fiscal 1963, but at least 12 are needed, ATCA concluded.

* Technical analysis of rules needed to provide safe functioning of all flights down to 14,500 ft altitude. Military restrictions that are not suitable should be removed from the program, which should be free of any "political poison."

The group expressed concern that ATA can't meet its fiscal 1964 budget request by keeping passenger seats at a minimum and posted out flight crews and too few controllers to handle the increasing volume of air traffic.

Budget Needs

Because of its mandate to expand and improve air safety, FAA can not function, in budget needs at the same time as an air carrier industry and should need lessening its approach that Congress has been "overprotective" of both.

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ATA presented view of procurement



TAG AIRLINES vice-passenger de Havilland Doves stretch get heavy utilization on scheduled flights between Detroit and Cleveland.

TAG Airlines Gets High Dove Utilization

By Ward Wright

Detroit-TAG Airlines, as an air line flying 50 weekly-scheduled flights between Detroit and Cleveland with vice-passenger de Havilland Dove aircraft, uses its operations as a model "bird's nest of success" between major points for business passengers.

John C. Brinkhous, TAG's general manager, makes a useful distinction between what he calls TAG's "bird's nest of success" and the traditional concept of flood-level service as a separate category designed to serve small and rural points unprofitable for local service carriers.

Business Passengers

TAG's role, Brinkhous said, is complementing railroad and local area air services between such major traffic hubs as Detroit and Cleveland, which serve industry and a large number of business travelers.

Travellers can't be picked up and down all day long between points like Detroit and Cleveland, Brinkhous said, "but we can handle them better," he added.

TAG's present philosophy has paid off with an income of exceeding \$400,000 with three round-trip Detroit-Cleveland flights in 1957 and now steady at eight even hours on the hour between 7 a.m. and 9 p.m. in both directions.

TAG does little advertising, "we are word-of-mouth," Brinkhous said. In spite of this conservative policy, TAG's passenger traffic has increased from 15,600 passengers in October 1955 to 24,300 for the four most months of 1957. Price seems to passenger response to TAG's service is its ability to use

downstream airports in Detroit and Cleveland which offer passengers a significant time savings in ground transportation.

TAG operates from Detroit City Airport about six miles or about 10.15 miles from the city center—enveloped with about 37,000 and 37,000 residential houses by the city of Hamtramck, Michigan, and Willow Run airports.

In Cleveland, TAG uses Lakewood Airport about 11½ miles from downtown. From the city center it is opposed to about 1½ miles to reach the city's Hopkins Airport.

TAG operates 16 flights a week at 3 to 3½ hrs. each way, the two cities compared with other scheduled services. Total round-trip time, including ground transportation for the 9½ miles between Detroit-Cleveland, is about 2 hr. for TAG flights compared with 3½ hr. and 7½ hr. for other scheduled services.

Brinkhous was unable to assess the impact of TAG's operation on railroads and local surface transportation because the two cities, but he noted that since TAG began fallowing night operations with Detroit, he sees a similar trend.

TAG has had an influence before CAB since February, 1960, to operate a similar high-frequency service between Detroit-Chicago, Pittsburgh and Columbus.

Outlook for 1962

In spite of that, TAG, which does not own, rent or lease vehicles, has experienced losses over year since it began operations. However, Brinkhous said, 1962 may be the turning point and TAG may show a small profit.

Brinkhous' concern is that it might be more profitable to operate longer hauls with larger peak loads but TAG's policy is to be as close to the vice-passenger route as possible by using smaller aircraft.

TAG has had an influence before CAB since February, 1960, to operate a similar high-frequency service between Detroit-Chicago, Pittsburgh and Columbus.

Several airline companies had originally been able to operate with smaller aircraft. Brinkhous' proposal, TAG might be exempted in the forthcoming Potos 840 hearings for such an operation, should CAB approve. "We'd have to make some change in TAG's service to make such a proposal attractive."

TAG maintains its operations with a total of 11 Douglas 12-passenger and cockpit, six executive, eight sales people and five persons in its general office. The airline has no headless operation. TAG uses 160 man crew.

Brinkhous estimated that 35 to 40 percent of TAG's customers are charge customers. TAG uses all major credit cards and airline credit cards as credit references and says no bills.

While TAG's customers are traditionally male business people, Brinkhous said, more women are beginning to use the airline. TAG also has a significant weekend clientele. Brinkhous said expenses per passenger average \$109.00 for the airline's revenue, Brinkhous added.

TAG's services to the Two Air Group has been operated since 1957 as a division of Miles' Old City, which controls a chain of filling stations and other petroleum facilities on the lower Great Lakes region.

Ross F. Miller, owner of Miller Oil and TAG's president, favors a possible sale for direct Detroit-Cleveland service when he bought the air line earlier this fall. Earlier, TAG had scheduled service between the two cities with seaplane flights and between the about a year ago during Detroit's winter weather, with the purchase of a Douglas Dove from the late Ed Horns, local from TAG's former owners. In the fall of 1957, Miller bought Blue Angels, an air line serving operating between Rockford, Ill., Detroit and Chicago—acquired TAG's Los and a Douglas Lockheed in July, 1958, and Chicago February, 1959.

Blue acquisition brought TAG a fleet of seven Doves. The airline acquired a Douglas Dove in January, 1959, and gave it up in April. During the fall, TAG sold one.

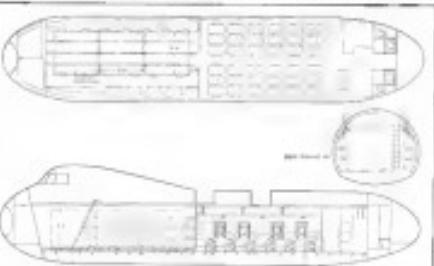
In the fall of 1958, TAG had reorganized its schedules in eight round-trip flights daily between Detroit and Cleveland. Flight numbers, 1601 to 1608, were used in the lack of permanent landing lights at Lakewood Airport prior to 1961. In those years, TAG primitive its own lights at Lakewood during winter for late evening flights.

In 1961, Federal Aviation Agency and the City of Cleveland installed permanent landing lights at Lakewood, putting the way for increased night operations. Last February, TAG reorganized its schedule to 14 round-trip flights, followed by 12 round trips in April, 14 in September and 15 round trips in October.



Crater section of box spar being lowered into place on a Series 200 Argosy air production line at Glider McWhorter's plant in Coventry. Wing design gives Argosy full tailwheel characteristics throughout the fuselage.

Argosy 650 Mixed Cargo-Passenger Version



Stair case passenger version of the Glider McWhorter Argosy 400 hydroplane transport, now being offered to several North American airfields (AW, Nov. 19, p. 49), carries up to 14,000 lbs. of cargo in forward under surface and up to 40 passengers. Layout pictured above is for 16 passengers and three cargo pallets forward. For increased flexibility in load and cargo, passenger seats can be folded into the rounded sections of the side fuselage (see reader action interview). Powerplants are four Pratt & Whitney Dart engines. Decompression opening of the Argosy wings plus (below) shows a section of three seats can be folded upright to provide additional space.



Boeing to Roll Out 727 Tomorrow; First Aircraft Will Go to United

By David A. Anderson

Seattle, Wash.—After all of the Boeing 727 development delays in scheduled service, with delivery dates ten months postponed before it makes its first flight early next year.

First flight, planned frequently in the last six and seven solar cycles that characterized the Boeing 707 prototype, eventually will be delivered late in 1963 as the first of 40 to United Air Lines. This is the first Boeing "front" not to be built in production-line form.

Total backlog is currently an order. In addition to United's 40 aircraft, Eastern Air Lines bought 46, in negotiations to order simultaneously with United is December 1962, and marking the program off on a firm foundation.

Largest addition to the order book was made last week, when the American owners of six aviation companies agreed to orders of two 727s each for AmericanANA and Trans-Asia Airlines.

Since then, Loftstrand General Aviation has ordered 12, American Airlines 25 and Trans World Airlines 18.

Major goal of the 727 program was to produce a short-haul jet transport that would have low operating costs and be able to compete in air traffic with short-range jets.

Executive market surveys defined the capacity and seating arrangements of the airplane. They showed that the 727 should be used around at continental route segments that could generate high traffic. The design also had to be revised enough to handle the longer routes where those might be less profitable.

Boring's studies showed that the world market for aircraft of this type might exceed 1,000 airplanes by 1970. The 727 was designed with the expectation of a large production run to match this condition of the studies.

Body around the fuselage, nose section of the 707 and 720 designs, the 727 will feature six abreast seating for a maximum of 114 tourist-class passengers. The interior also will be planned around 70 first-class passengers.

With interior volume and fuselage size so well defined, the Boeing designers developed a wing with a small area-on-wing loading—in increasing drag and to get the desired high-speed performance. High-lift devices were developed to give the airplane the short takeoff and landing required.

Tapered wings extend six feet down at a 60-degree angle and increase the effective wing area by about 10% at 9° nose-up wing angle or 1,650 sq ft. Wing also has outboard slats in four segments, and reduced Krueger flaps in three segments. This results in accumulated another 250 flight hours testing the flaps and engines.

Totally structurally complete airplanes will be built and test-flown to destruction. The first of these already is being installed in the test stand and testing is scheduled to begin in February, 1963. Fourteen test flights will be made on the second aircraft later in 1963, and will include a total of 12 months of accumulated test flights, considerably more than 150 hours of engine operation.

Cost for the first flight will be \$ 1.5 million, which is a new capital cost test pilot and 727 project pilot, R. L. Louch who is Boeing chief of flight test and analysis, and M. K. Shadelberger, Boeing chief flight engineer. He will be 727 flight engineer.

Boeing 727 has a 108 ft. 7 in. wing span, 134 ft. 9 in. wing overall, and 133 ft. 8 in. high. Flying weight is 32,000 lb. at the maximum gross weight. Landing weight is 131,000 lb.

Cruise speed will be varied from 550 to 600 mph, and cruise altitude from 30,000 to 33,000 ft. Operational ceiling is 42,000 ft.

The 727 is restricted above all times by convertible hydraulic controls. The over-all control and autopilot system has provisions for multiple channels and parallel operation of the primary systems.

New advanced systems, working like the switchable selector in a car, will be required by Boeing for maximum safety. It can be used while the high-speed servos switch between operating and test conditions well into a single approach.

Air Force, which operates one flight a week between New Delhi and Moscow, may eventually extend the service to London. Aeroflot has two flights weekly from Moscow to New Delhi. Aeroflot and Air India services between the two countries operate on pool basis.

Aeroflot To 124 Service

Soviet airline Aeroflot has started the first regular scheduled service of its twin-turboprop Tu-124 transports on Moscow-Ulyanovsk and Moscow-Gorky routes.

Flight time for the 360-km Moscow-Ulyanovsk segment is 1 hr 15 min, for the Tu-124, as compared with 2 hr for the ill-fated piston-engine aircraft being replaced. The maximum range capability makes the Moscow-Gorky flight in 49 min. For the port two runs the airline had promised that regular Tu-124 service would begin "in the near future."

India, Aeroflot Agree To Extend Air Service

New Delhi-Russia and India have agreed to the extension of Aeroflot's Moscow-Gorky-New Delhi route to Bangalore and Jakarta Indonesia, and to the extension of An Indian's service to ports beyond Moscow.

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AVIATION WEEK and SPACE TECHNOLOGY, November 26, 1962

Early Selection of Heliport Sites Urged

James R. Adcock

Heliport.—Continued use of paper-thin ground heliports developed earlier is not feasible for areas in an increasingly establishing helicopter sites to meet the helicopter's growing importance to public transportation, delegates to a nine-day conference here were told.

City representatives, most of them from Commercial, were advised on how to open their communities to scheduled helicopter service. The conference was sponsored by the American Helicopter Society and the Greater Hartford Chamber of Commerce.

Resumption of site changes is required to facilitate heliports and perhaps the education will come in three vital considerations in site planning toward attracting helicopter service.

"The first is to locate and certify that we are fully aware what is in the air space," said James R. Boren, chief of the map guidance armament section of Federal Aviation Agency.

"The civilian people you have been exposed to have probably rarely if ever seen a helicopter and even," Boren said. "But keep it simple and straightforward."

Boren suggested that heliport plans be placed on overhead signs above highways and freeways and on structures over rivers.

Lock of Uniformity

Each of, unfortunately in citizen's eyes, two proposed helicopter sites was moved by Boren for certain reasons, demonstrating and reinforcing particularly uncoordinated site locations.

Citing the safety record of heliports, Boren said the three U.S. selected routes have operated for years with only one accident in each. Chicago (AW Aug. 1, 1962, p. 14) raised doubts of its safety of passengers.

"Bear in mind that the three routes today are carrying perhaps 90,000 passengers per month and this accident is the first and only one involving passengers or site operators other than operators' boats."

He said that of 120 accidents involving both private and commercial helicopters in 1960, only three or 2.4% occurred in urban areas.

"To me knowledge no person on the ground has ever been injured by a helicopter in these accidents," Boren said.

Safety of roofing operations is essential, he added. At two Chicago operations fitting lagged over 115,000 window frames and landings without incident. Los Angeles Airways, an air taxi service (AW Aug. 27, p. 40) per-

firms over 800 roofing flights every month, he said.

Flight tests down the east and west coasts of the country, he said, are progressing in establishing helicopter sites to meet the helicopter's growing importance to public transportation, delegates to a nine-day conference here were told.

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"The second is to take their place in one of the several facets of the urban community in the 1960s as they have in some communities already," Boren said. "The language communists often repeat that helicopter noise is considered just simple as a problem of controlling a nation, but at making it possible for the various types of helicopter operations to move the economy and its effects."

Helipad Guide

Verted Left Aerospace Council and the AIA have distributed a pamphlet as a guide to communities on helicopter dimensions. It shows that a 75-ft. sq pad will handle small single-engine aircraft while 100-ft. sq areas are necessary for large twin-engine transport helicopters. Approach and takeoff elements should be based on 1 ft. of vertical clearance along at least two flight lines, which would be determined by landing needs.

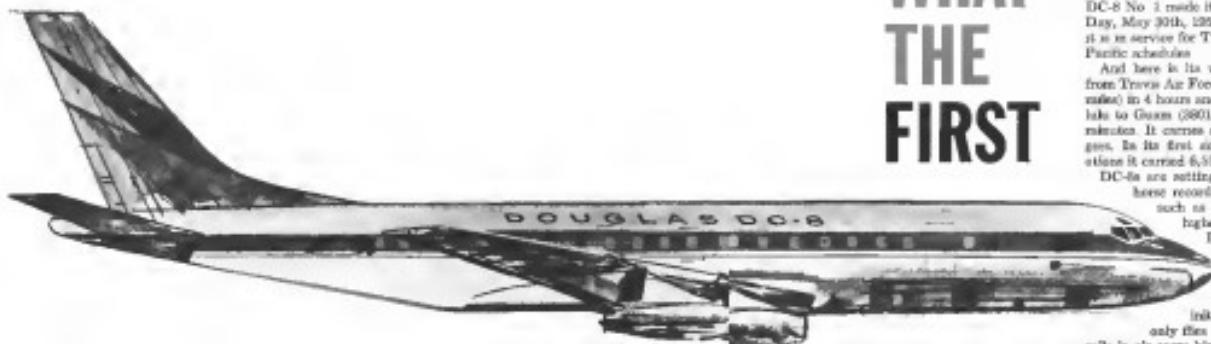
David G. Davis, deputy director of communications for aviation at Philadelphia, and other city hall officials plan to present a formal report to the city to provide a guide to communities on how to evaluate, operate and maintain helicopter facilities as a public convenience. Phil adelight would then train heliports in much the same way it would a non-pilot aspect.

He said that a report due for Philadelphia by a transportation consulting firm recommended that a public heliport be included in a proposed downtown project.

"It recommended also that adequate helicopter facilities be installed at our two existing airports, and that land be reserved for the future installation of five or six public heliports."

AVIATION WEEK and SPACE TECHNOLOGY, November 26, 1962

DOUGLAS BUILDS GREAT TRANSPORTS



LOOK WHAT THE FIRST

DC-8 IS DOING NOW!

DC-8 No. 1 made its first flight on Memorial Day, May 30th, 1958. Today, 4½ years later, it is in service for TIA, flying regular MATS Pacific schedules.

And here is its warhorse record: It flies from Travis Air Force Base to Honolulu (2437 miles) in 4 hours and 35 minutes; from Honolulu to Guam (380 miles) in 7 hours and 50 minutes. It carries an average of 169 passengers. In its first six weeks of MATS operation it carried 6,338 passengers.

DC-8s are setting performance and work-horse records all around the world... such as flying faster, farther and higher than any other jetliner.

Latest in the series is the world's first all-jet air freighter, the great-new DC-8F "Jet Trader," which recently made its initial flight. This aircraft not

only flies at the lowest cost per ton-mile in air cargo history, but also can be converted to any of 12 cargo-passenger configurations in less than 2 hours.

DC-8 No. 1 is another example of the reliability of Douglas aircraft, demonstrated during 3 decades of service. Thirteen thousand Douglas transports... DC-3s, 4s, 6s, 7s and 8s—C-45s, 84s, 118s, 124s and 338s... have been the workhorses of military and commercial air transportation... and you can expect even greater things from future Douglas transports.

DOUGLAS
AIRCRAFT DIVISION

NEW
POWER
FOR
SPACE

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**Pratt &
Whitney
Aircraft**



First Belfast Freighter Fuselage Undergoes Water Tank Testing

Best complete feeding of the Short-tailed Bristle-nose froglet by Raoul. An Euston-stated recent score of frogs in water took a Short-Brown & Blakeland pond in Northern Ireland. Frogs will swim about pond and fly land with water piped through the feeding or conversion tank. Total area more than 150' of long and wide 800,000 gal. of water. Bristle-nose of Bristle-nose froglet held in 12 chosen no bottom holes. Hold has a mean size of 12 800 cm. Bl. sitting in honeycomb-mesh enclosed between two layers of aluminum. At night froglets at wounded eye center break.





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USA: BRITISH AIRCRAFT CORPORATION (USA) INC., 309 JEFFERSON DAVIS HIGHWAY, ALEXANDRIA, VA, VIRGINIA

AIRLINE OBSERVER

► British Overseas Airway Corp. is studying a Rolls-Royce proposal to retrofit the airline's Boeing 707s with Conair RCO-42 aircraft now being used on the Viking VC-10. That decision will probably be made early next year. The manufacturer claims that the Conair propfanjets will give BOAC a 10% savings in engine operating costs.

► Delta World Alliance will retain a high share of schedules across the Atlanta hub over the next six to eight years, on the strength of its 17-day express service from Eastbound advance bookings. For this month up 25% over November, 1991, and, year-to-date, 32.1%. Elsewhere, eastbound bookings are up 35.5% and westbound show a 22.7% gain, partly due to TWA's special Christmas booking of economy group fares for U.S. military personnel and their families stationed overseas. Through May 31, the airline will provide 84 passenger flights a week across the Atlanta

► Turbostar equipment now provides 82% of domestic trunkline service, compared with only 5% four years ago. Tuahalli aircraft continue to gain in importance and now account for one-fourth of the jet passenger total.

► British Aerospace Corp.'s sale of three BAC 111 turboprops to Central African Airlines (Africa, Oct. 3, p. 27) is expected to lead to orders from at least two other African carriers soon. Sales patterns generally indicates that purchases have been satisfied operation of either the Vickers Viscount or de Havilland Comet. Seven African airlines currently operate these aircraft.

► Civil Aviation Board has expanded its new Handbook of Aeronautical Information, due for release in the mid of November. Content are updated and will include new topics such as historical specimens, state and federal fuel taxes, traffic volumes by route pairs, and jet penetration of major markets.

The International Civil Aviation Organization is urging airlines to reduce rates for freight carried on passenger flights to a figure below quota average operating costs, as the means of offsetting excess cargo capacity. For each pound carried by air, surface freight services save less than ICAO costs, and airlines may have to consider more cooperative arrangements, such as exchange, sale of space to one another and pooling in order to meet the cost reduction.

Soviet Aviation Soviet plans to start regular continental service from Moscow's new Domodedovo Airport in mid spring. Construction crews are completing the 1,300-ft long glass, aluminum and concrete building which has separate covered passageways extending from each end toward the field. Passengers will board in horizontal rows from two main passageways. Domodedovo has a completed five-story, 900-seat hotel. It has been designed to handle Vostok's Tu-104 transports, including the four-turboprop Tu-104A and the new, four-turboprop Tu-105.

■ American Airlines is confident that experience with such new jet freighters as the Boeing 727 and Douglas DC-8F will encourage CAAC approval of lower cargo rates. Conspara spokesman estimates that two years of cost analysis will be needed before rate reductions can be recommended.

Nigerian Airways management is being investigated by the Nigerian government after a series of sharp clashes between its chairman, Chief Fadipeh and his deputy, Chief Elkuli over the handling of airfares. The Lagos Daily Times reports that the investigation not only includes charges of "treasonable acts" which form political intrigues within the company.

Swissair has signed a firm order for one Series 51 Douglas DC-9-10 aircraft to transport its delivery west. Delivery is to take place in time for service over the North Atlantic late in 1965. Powered by four Pratt & Whitney JT8D-1 engines, the aircraft design incorporates a new wing leading edge and fuselage extension capable of accommodating 132 passengers in economy configuration, or 125 in standard 142-seat configuration with 16 firstclass seats plus lounge and 125 economy-class seats.

SHORTLINES

Allied Airlines has asked Civil Aviation Board approval of two new group travel plans designed to attract new passengers. One plan would permit group tourists holding roundtrip tickets to return independently and the other allows owners of group travel tickets to get 20% off the normal passenger fare.

Comments Air Lines flew 82 million enroute passengers during last month, or a 12% gain over October, 1964. A 45% gain was recorded in the airline's Chicago-Bureau City-Denver-Los Angeles route, while traffic over other segments increased 10%.

Local service airlines recorded a 19.7% gain in average passenger rates for the first 10 months of 1982 as compared with the same period a year ago. The industry's average system load factor increased to 81.6%, compared with 77.7% for the first 10 months of last

Molusk Action has reported a third-quarter profit of \$355,574 for a nine-month profit of \$421,288. Last year the action showed a third-quarter profit of \$42,255 and a nine-month profit of \$399,552.

• Northwest Airlines will operate new nonstop all-cargo round trips across the Pacific to Dusseldorf. The service will be in addition to the cargo space on Northwest's regular passenger flights and a weekly DC-10 cargo flight between New York and Tokyo.

Pan American World Airways will begin a weekly flight to the island of Pago Pago on Dec. 2. It will also provide biweekly service to Niue, Fiji and

Sabena Belgian World Airlines will include four club Stinson S-18 flights in its fall and winter helicopter schedule between Brussels and Eschweiler, Kehl and two daily flights between Eschweiler and Rotterdam.

Scabard World Airlines has earned a third quarter profit of \$801,000 on the basis of 56.5 million in revenues. For the first nine months of this year, the airline has experienced a loss of \$1.1 million.

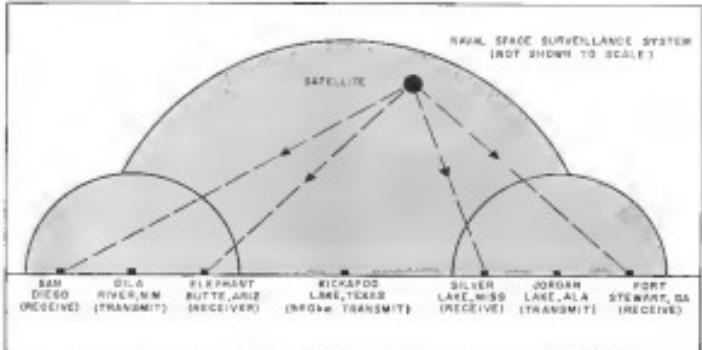
Stobbs Airways has taken delivery on its first de Havilland Comet 4C and will receive a second before the end of the year. The airline plans to expand its present route system to Oceania and is considering adding service to India in the next 18 months.



Since going into service four years ago, Boeing jetliners have carried 30,000,000 passengers and will have flown more than 700,000,000 miles. They have set more than 500 speed and distance records. But more important to airline operators, Boeing jetliners have demonstrated rugged reliability and the unprecedented passenger appeal that made them the most popular airliners in aviation history.

BOEING Jetliners

AVIONICS



NAVAL SPACE SURVEILLANCE SYSTEM, which detects and catalogues Soviet satellites, uses these transceivers to produce two series of electromagnetic energy, switching from Atlantic to Pacific orbits, plus four receiving stations to determine satellite position.

Spasur Net Giving Vital Norad Coverage

By Philip J. Kline

Dahlgren, Va.-Naval Space Surveillance System (Navspasur) has developed from a germ-birth experiment into a vital operational element in the North American Air Defense Command's Space Detection and Tracking System (Spasur) in less than four years.

As a satellite passes over a great circle which stretches from San Diego to Stewart, Ga., it generates a thin curtain of electromagnetic energy erected by Spasur. Instantly the four Navspasur stations here at Navspasur head quatern to track out less black "dots" marked while other pairs drop their random oscillations and begin to trace out digging lines.

Direction of the digging shows the satellite's heading. From a few other simple measurements, operators soon quickly determine the time of initial perigee and the satellite's current location. This is compared with similar data on when and where previously catalogued satellites are expected to pass through the Spasur fence.

Unlike the two sets of data which surface close from the system, a new satellite is often an off-donkey find, breaking off an existing spectrograph. Data on the unknown is immediately transmitted to Navy headquarters in Colgate-Somers, Maryland. Norad will be given data from other sources such as the Bilbao, Madrid, Paris, Warsaw, Seoul, or Cincinnati and Alaska or from other radars and sensors, within and outside the U.S. to assist in object identification.

Unusually modest cost of constuct-

ing, to obtain specific values for Spasur and perhaps it is success in space will prove it is serious. In one month 12 hr until the earth has rotated 180 deg, to prevent the network a look at the opposite side of the orbit.

Satellite launched at an equatorial inclination less than approximately 35 deg does not get far enough north to penetrate the house except at its extremes when dip is low as in about 25 deg. Intensity of the signal is constant. Elsewhere under uniform conditions the diggers are oblivious to the continental U.S. range for certain satellite positions of the nation.

Another innovation of the present network applies to Soviet satellites launched at higher inclination angles.

A Soviet satellite at a 30deg inclination may not pass through the Stewart fence until it has been slant for about three miles while one at a 65 deg inclination requires about five miles to be detected by Spasur.

Thus an innovation of the spectrograph function of the present network and not just enhanced functioning of the spectrograph. If new satellites were catalogued in the Western Pacific both of these innovations would be overcome.

But Navy spotters emphasize that they are not paying hard to get funds for a Spasur extension, although such a move is believed under consideration for the Fiscal 1964 budget. They em-

phasize that now each Spasur extension must be weighed against the operational need for added capacities as well as against other pressing defense needs. The Spasur technique is one which requires relatively short lead time in planning, location and install it should the need arise. Navy spotters point out:

"Response network is an adoption of the radio intercommunication techniques developed by the Naval Research Laboratory (NRL) for tracking Project Vanguard satellites, known as Monogram."

First Spasur feasibility demonstration in February 1958 using the Sputnik 2, exploded the Marconi station at Bisbee Point, Md. and a Merrimac, California, transmitter at the Army Signal Corps Laboratories at Ft. Monmouth, N.J.

Network Location

Present location of the Spasur net work results from the fact that the main track stations near San Diego and Ft. Stewart, Ga., could be quickly converted to the Spasur function.

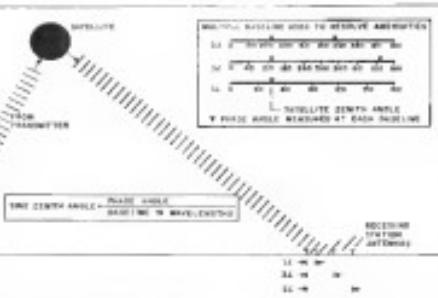
On Jan. 20, 1960, the Advanced Research Projects Agency, working with the Naval Research Laboratory, developed a surveillance system to detect and monitor orbital penetrations by non-catalogued satellites. On March 10, 1960, NRE had a two-station facility in operation with a transmitter located at Jorda Lake, Ala., and the modified Merrimac station at Ft. Monmouth, 250 mi to the east.

On Dec. 22, 1960, the first signal to be received simultaneously by two stations at Ft. Stewart and at Silver Lake, Miss., 250 mi west of the transmitter, occurred when an Atlas booster carrying the Soviet communications satellite was placed in orbit. But the signal was about 10 microseconds off first between the digger and receiver and there was a lag of about 10 sec before the signal was received again, according to Capt. W. F. Berg, head of the Spasur Branch Office of Chief of Naval Operations.

Stations Network

But in February, 1961, a navigation network was up operating in a 24-hr/day basis. In addition to the custom complex already cited, the network included a western complex with three stations at Gila River, Ariz., and western stations 250 mi to either side at San Diego and Elephant Butte, N.M.

Since then there has been a steady effort to develop and introduce improvements and this process is continuing. In June 1961, for instance, the main ground VHF pair ever built, was installed and placed in operation at Kickapoo Lake, Tex., to improve greatly the range and coverage of Spasur. The other two transmitters have permanent 50-km beamwidths.



NAVSPASUR DETERMINATION satellite zenith angle by comparing received zenith angle at several stations after displaced to coherent direction. Crossed-dipole antenna geometry approach allows more precise angle measurement.

Crossed dipole Spasur is ingenious enough. The Merrimac tracking station design was based on using receiving antennas equipped with small spatially separated dipole elements and having a low-power transmitter. Beamwidth, resulting in 100 deg in the satellite. By comparing the phase of the 100-mc signal received at the several stations at each tracking station, the angle (with respect to the zenith) can be determined. With data from the two or more stations, triangulation provides data on satellite position in space and its altitude at any given instant in time.

Studies by Naval Research Laboratory scientists indicated that the technique could be adapted to use more than two crossed dipole transmitters, providing their power was sufficient to reflect back to earth a signal whose strength approached that of the 100-mc carrier signal. Calculations indicated that a 90-deg beamwidth per station would provide such power levels.

NAVSPASUR SEPARATION between receiving antennas provides correspondence in errors in angle measurement.

Thus transmitters were installed, one a 1,000-watt antenna at Kickapoo Lake, and a 600-watt antenna at the other two sites, providing a narrow beamwidth of about 10 deg. This, together with a beamwidth of about 10 deg, is a north-south directional capability extending into the Atlantic and Pacific oceans.

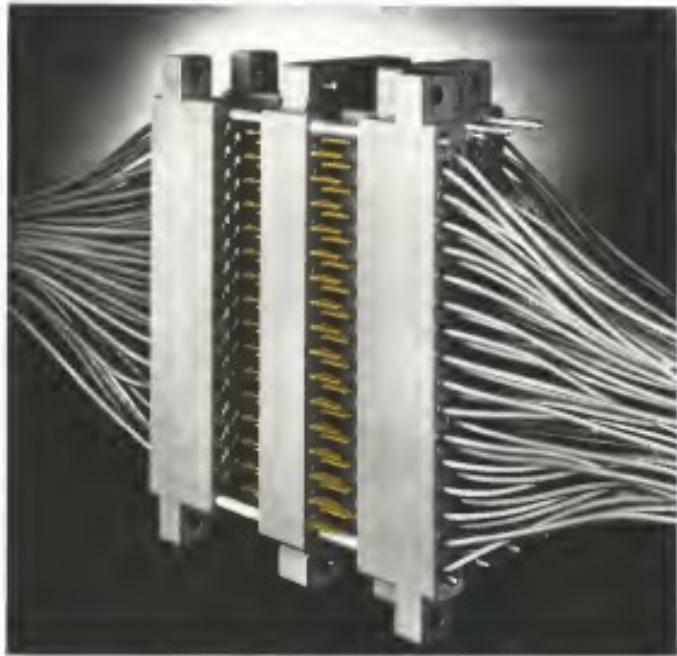
Narrow beam width in the north-south direction enables the network to get a fix on satellite position in that plane. The signal operating frequency of 108.00 mc was changed in December, 1960, to 108.815 mc to expand tracking coverage extending at the Merrimac frequency.

Receiving Stations

Enough latitude afforded by the network makes use of many stations, the receiver determining the approximate position across the fence in an East-West direction and its altitude. Each receiving station has a series of antennae arrays, running north-south, which are deployed from one another in an east-west direction by distances ranging from a few feet to distances of at much as 4 miles.

Closely spaced elements in the array determine the approximate location of the satellite while those having larger beamwidths determine its position within any one meter with great precision.

Merrimac baseline (displacement between elements in an array) is open several times today in 510 ft, 510 ft, 510 ft, 510 ft, 510 ft, 510 ft, which makes it possible to determine the angular position of a satellite to within 0.1 deg. Currently installed and under evaluation at three of the sites



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is a 5,200-kilometer antenna which is expected to improve angular resolution to 0.01 arc sec.

Even more important than the improved angular resolution will be the ability to measure the rate-of-change, or velocity, phase of the reflected signal. This, it is hoped, will make it possible to obtain axis orientation on similar ellipticity during the line pass according to Roger Linton, head of NRL's Space Surveillance Branch.

Radar signals received at all four stations are recorded, processed by software and then transmitted to a National Laboratory back at Washington, where a central tracking station. Signals that are transmitted to NRL and re-transmitted to USNO in order to obtain the most accurate and system jet frequency.

Satellite Catalogue

Running catalogue is maintained by an ever shifting and orbiting collection which had been previously determined. The Naval Ordnance Research Computer (Nord) is used to calculate orbital parameters for all such objects and to predict their likely positions of where another can be expected to pass through the horizon at short notice, thus increasing and approaching interest.

Thus, the Jovian operators here are alerted to the expected arrival of known satellites.

As soon as a known satellite passes through the Square Box, the recording begins, since its presence

unperturbed until it does not necessarily mean a new known satellite in orbit. It could, for example, be a known satellite which is beginning to re-enter the atmosphere. During the period of orbital decay, it becomes increasingly difficult to predict accurately the orbital parameters.

Bumper break up

Or the opposite may be the result of a break up of a known satellite or space craft. For example, in June, 1962, the satellite body of Transit 4 exploded and produced more than 100 individual pieces of debris which greatly increased the number of objects in orbit, although to Capt Edward von Reibell, commanding officer of Navigator, Capt von Reibell came here from Nord when he directed the space surveillance plan office.

To determine a cause durable enough for human judgment must be applied. This is done by the Space Object Identification and Analysis section of the Space Object Study division of the Naval Space and Missile Systems Center.

This explains why the Navy has issued continually as attempting to estimate the present status and data entry of



SPASUS BRIEFING STATION, one of four in network, has L500-ft long antenna, designed to detect presence of other satellites plus 400-ft long array, displayed on east coast direction, to measure relative phase angle of signal reflected from satellite to determine its zenith angle position and altitude. One of delayed status is visible just beyond main dish. Currently under evaluation are arrays displaced 3,200 ft, which would provide angular resolution to nearly 0.001 deg.



NAVY SPASUS OPERATIONS CENTER at Dahlgren, Va., which now requires human analysis of all satellites passing through space surveillance lines, now will have semi-automatic facility in which computer will analyze each entry, determine which are presumably catalogued satellites and alert human operators to new unidentified objects in orbit.

residual. Navy hopes to take a survey step toward reducing the amount of human analysis required. Signals from all its sensors, now assembled up in sailing format, will be converted to track its position against fixed stars. Information

units that are already catalogued, enabling them to decide their orbits and confirming new ones, according to Col. Robert E. Carter, executive officer of Spasus.

Space Objects Inventory

Now for reducing the mission work load of the human operator is planned by the data processing section of Spasus in space. In January, 1962, just before the return visit into 24-hr. operation, there were only 10 objects in orbit and a year later the total was only 14. By January, 1963, the number of objects in orbit was 15 and by January, 1962, it had multiplied to 259. While much of that number was debris from Thor 4, these were about 46 while others were in the Thor 4.

In February, 1963, Navigator was updating about 2,000 nuclear observations made previously by Nord, but by the fall the number had increased nearly 1,000 to about 25,000 per month, according to Lt. T. K. Oberon, USN, who is in charge of the Navigator semi-annual catalogued master file.

At present orbital data on all known



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satellites is updated once a week and transmitted to Naval research stations on the basis of orbital decay, whence parameters change rapidly. These are updated every day by Naval and Space Weathermen.

With the new IBM 3900 computers used for system automation, and an older 3900 which will be used for back-up and off-line computation, Dr. van Tolhuis expects to keep an up-to-the-minute catalogue of orbital parameters for all objects in the space inventory.

Spacequarters Move

Navspacelab Headquarters soon will move out of its old office building which now houses about 100 people. It will move to former headquarters of Naval Weapons Laboratory 60 mi. northeast of Washington. The earliest facilities here reflect Spain's heavy beginning in an NRI program and held an important role in the Naval Spacelab network.

Despite the fact that stations in the Spanish network do not have dual-band bidirectional equipment available to permit instantaneous changeover in event of failure, the network currently exhibits reliability of better than 99.9% according to van Tolhuis. The network stations are operated and maintained by Spanish Radio under contract. Brinda roughly about 100 persons in the seven stations for round-the-clock operation. Here at Navspacelab Headquarters there are about 50 persons, including 12 military personnel, assigned to provide continuous

24-hour surveillance by the Navspacelab. Prospect of uniformly revised antenna standards has important military implications for satellite operations, which explains Navy's keen interest in Spacelab. The cost nucleus of the system no longer provide the implicit security their rate did.

If the first can be kept posted on the time and position of sun-Earth conjunctions which might be reentry-type types, it can take steps to reduce reentry date. For example it can shut down solar cell radiator transmission during satellite passage.

If there is unusable closed cover on the sun-side, a doghouse can shelter them. If there is no closed cover a doghouse at least reduces speed to minimize reentry and reduces its visibility in a window.

Once a week the orbital parameters of all satellites in the inventory are transmitted to flight managers. They also serve as spotters for Spacelab reentry track. If radio intercepts were occurring in the atmosphere, which enables basal questions to record the density of reentry on the range of decay.

Systems Improvement

Since the system first became operational early in 1972, the Naval Research Laboratory has had a continuing program of research and development aimed at improving system performance to meet more demanding operational requirements. An important advantage of the Spacelab technique is that the system performance can be upgraded on



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CINCINNATI



Simulator Uses Film of Lunar Surface

Edged strips of the moon's surface is used in space flight simulator built by Lang-Tessin-Voigt's Astronomical Division (AVM) (see p. 77). Film is projected in a series of large optics comprising objective, eyepiece, and projection lenses, in relation to each other and additional projection provide pupils permitting simulation pilot to pursue rendezvous maneuver procedures. Colored objects stop elongated areas are counter balances for moving base simulator.

a permanent basis at reduced without major expense.

Receiving stations at Ft. Stewart monitor an R&D facility for evaluating new techniques and therefore differ somewhat in configuration from the older three stations.

But even among the other three receiving stations there are some minor differences that do exist.

Antennas used at all stations, both monitoring and receiving, run in a north-south direction. This gives a narrow beam in the north-south direction and broad coverage along its east-west directions. At the receiving sites

the parallel north-south elements of the array and its measure relative phase of the received signal are displayed from six switches in an eastward direction. Each of these elements is 100 ft long. In a north-south direction, except at Ft. Stewart where most of the elements are 1,000 ft long, the arms at Kauai, Maui and Ladd Air Force Base are 400 ft long.

In addition to these phase-conjugate antenna elements, each receiving site has a second "alert antenna" which is 1,000 ft long at Sea Base, 400 ft long at Ladd and Elephant Butte and 400 ft

long at Ft. Stewart. The alert antenna's increased length enables it to detect a satellite a few minutes before a signal is detectable on the phase-conjugating antenna. The signal from the alert antenna is transmitted to Space headquarters and NRL in Washington and appears in a large horizontal bar to alert users operation in an impending satellite signal on the phase conjugating channels.

But the basic reason for the alert antenna is to increase the Doppler shift on the original transmitted frequency. This is done by providing a constant velocity of a satellite with respect to the receiver and receiver so that the low-band receivers can be used with no initial enhancement of signal strength.

Comb Filter

To measure the precise frequency of the received signal, NRL developed a 1000-ft north filter in which each element has a 100 cps bandwidth. This information then is used to tune the station receivers automatically to the exact signal frequency.

Equipment providing this narrow band preselector function built by Rockwell International and the contractor in the early 1960s resulted in a "major improvement in antenna performance," according to Naval Research Laboratory's Roger Evans.

The 1,000-ft-long alert antenna actually consists of four 400-ft-long segments which supplied signals are combined so that the four segments function as a single antenna. But the four signals also can be taken separately for phase-comparison to determine a satellite's position more accurately within the narrow beam area in a north-south direction.

Another signal transmitted from each of the receiving stations to DODCOM and NRL is recorded in the setting of the alert antenna to provide a reference distance scale of signal strength. This enables operators to estimate the size of the satellite, taking into account the satellite altitude and distance from the station.

Wave Scanning

A amount of bending of radio waves as they pass through the atmosphere interferes sets a practical upper limit on the altitude resolution that can be obtained. In going to longer wavelengths, Barnes points out, "Tech experts under way or planned are faced at determining if the 5,200-ft baseline is also the point of diminishing returns as wavelength or longer baselines should be employed."

To check the accuracy obtained with the new 1,000-ft array, NRL is photo-projecting the Echo satellite against a star background to determine its position precisely and then comparing that



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New Solar Panel

Solar thermoelectric panel, one of these 4 x 4 in. panels to be launched this fall from Vandenberg AFB for orbital tests of new-type power source built by General Atomic Co. Lockheed and USAF. Panel consists of small thermoelectric elements sandwiched between two thin metallic sheets, one of which reflects solar energy and converts it to heat while the other serves as insulator to cool panel. Back panel produces 6 watt

with the portion which has been damaged by the Spacelab system.

Another experiment planned for next spring will use a satellite equipped with a 400-watt transmitter. Because 1000-solar-panel radiation decreases as the square of operating frequency, the difference in apparent satellite position as measured at the 163.815 mc Spacelab frequency and at the satellite's own 900 mc, will give a measure of the reflection error.

Spacelab's radiation detection range and orientation determine planet size and distance, a number of factors which, in turn, define target size, the target angle and whether it has reflecting surfaces. Spacelab has opened the small design weight and in its 15 ft. long arc released it to Equator 5 and it regularly sources reflected signals from the moon.

If additional range should be required, it could be obtained by adding to higher power transmitters, narrower pointed mouth lenses or higher gain antennas. Despite the great use of Spacelab's reflectors, they are relatively inexpensive because they consist only of highly polished, simple fiber optics. If appropriate, they resemble a family group of TV antennas.

For the same reason it is often easier to change or modify the Spacelab antenna array.

Many spacepeople believe that Spacelab is inherently contamination-proof. If the Soviets were to try to do it by putting a 100-watt transmitter aboard their satellites, it could easily provide a greatly enhanced signal and cause

satellite detection by the Spacelab system. Since Spacelab went into operation nearly four years ago, it has been able to catalog every satellite or space object sighted except for an unknown in April of this year which has not been sighted again.

The one-time visitor might have been a large meteorite which passed through the lower layer before entering the atmosphere.

Another possibility is that the object was the Long March 3 satellite launched by the Soviet Union on Dec. 4, 1972. It has traveled the earth in a highly elliptical orbit and swing back around the earth.

If Long March 3 did not re-enter the atmosphere, as it does from the moon, it would swing back out into space on a highly elliptical orbit where passage would be difficult to detect without knowledge of the initial track rate. Infrequently, it would thus swing back around the earth spending only a very brief period in the vicinity before swinging back out into space. Unless the earth passes in front of the satellite, reentry is supposed to be such that it passes through the Spacelab floor; it might not be sighted again for many months if ever.

From the meager data obtained during the single pass of the satellite in April, scientists estimate that it had a velocity which would give it an apogee of about 106,000 mi., which fits the Earth's 5 hypothesis.

Acrylic glasses used for the screens require special production techniques with tolerances held to .001 inch. The lines are engraved, then hand-filled with blackout paint.

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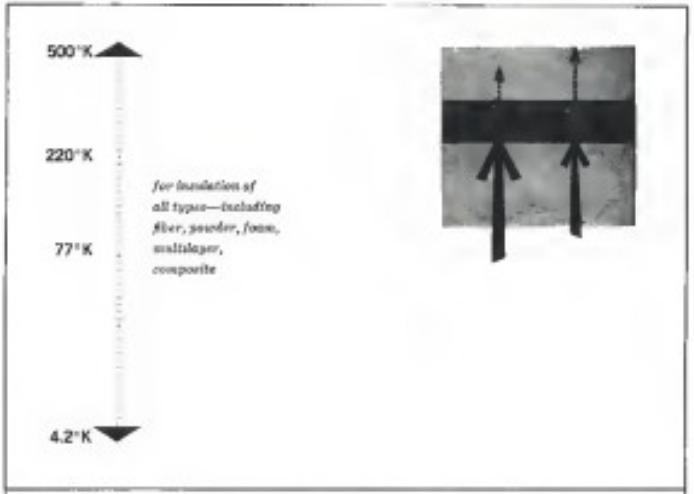
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JPL Centralizing Space Mission Facilities

By Barry Miller

Pasadena, Calif.—Centralized facility for simultaneously controlling multiple and spaceflight mission will generate operations here early in 1964 at Jet Propulsion Laboratory, prepares for the complex task of handling a heavy ongoing schedule of planetary and lunar space shots.

Now \$12 to \$15 million facilities, to be known as the Space Flight Operations Facility (SFOF), will be an expanded, updated and centralized version of the operations center and supporting installations located here which currently direct and control the center's unmanned lunar and planetary probes after launch from Cape Canaveral Management of these space liaison is Jet Propulsion Laboratory's prime management, under contract from the National Aeronautics and Space Adminis-

tration that comprises with three lunar and two planetary attempts this year. And as more complicated lunar space craft with longer operational lifetimes develop, SFOF will play the key role of integrating various mission types.

In 1964, JPL will take the risk of controlling and commanding a pair of planetary and a single lunar spacecraft at the same time. The 1966 lunar satellite should extend this, making the overall problem even more complex.

Present Operation

At present, JPL conducts its flight operations from a severely limited Space Flight Operations Center here. When overlapping shots occur, as they did recently when Ranger 5 was launched as a successful lunar mission while Mariner 2 was moving toward Venus, facilities have to be shared. Mariner did not have to coordinate with control centers of Ranger and maintained its own general character of operation before flight; response would descend on the center.

Expanded Tasks

SFOF will be expected to provide initial guidance, navigation information, and all mission planning, monitoring and recovery functions for all projected flights on the several segments of lunar and planetary projects (Ranger, Mariner, Surveyor and Voyager). Among its unusual features, SFOF eventually will contain a sensible laboratory to enable scientists at the facility where experiments are aboard the Surveyor lander to control it in real time and read out information from their dream operating on the lunar surface.

JPL's international tracking and com-

munication network, the Deep Space Infrared Network (DSIN), provides continuous communication via 24-bit links of up to contact with its space probes (ATH, 100 ft. p. 173) and will be SFOF's principal interface and telephone lines and ultimately by solid-state microwave communications.

Wideband microwave measurements link, which will relay television image signals received from Surveyor lunar spacecraft from the Goldstone, Calif., DSIN sites to JPL, presently is being constructed by Western Union.

The DSIN sites will ensure that telemetry and tracking data are received from the spacecraft, and commands calculated in SFOF are forwarded to the spacecraft. These sites will be controlled from SFOF.

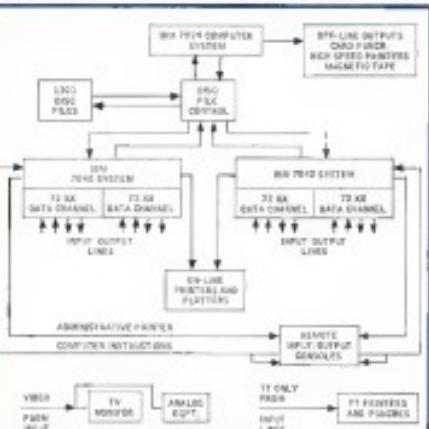
Next for a centralized facility like SFOF increases at the number and density of JPL's research and development units. In SFOF's first annual year of operation, for example, NASA plans full day-long planetary and Earth

New SFOF will provide these advantages:

- Ability to carry out multiple experiments
- Increased capability for performing simultaneous checkout of spacecraft before launch, for reporting and status checks and for rapid recovery.

- Being together was a major factor in the future space flight operations facility, its communications center and all relevant data processing equipment.
- Ability to display real-time television data
- Growth potential with a planned plant build along similar lines.

- SFOF will be implemented in steps, gradually increasing the probability of achieving an operational system sooner and preparing JPL to gain experience before SFOF grows into its final configuration. The growth steps are:
- Stage I—in January, 1964, the facility is scheduled to be able to service two missions simultaneously, using separate regenerators. In addition, it will be capable of preparing for a third mission with closed-loop operational test



BLOCK DIAGRAM indicates major data processing logic to be employed in Jet Propulsion Laboratory's new Space Flight Operations Facility in Pasadena, Calif. Video data from spacecraft are fed electronically to data processing as well as to television monitor. All 12 telecasts from SFOF go to data processing and, as a backup, to remotely located teletype printers and punch machines.

MERCURY JOURNAL

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29 July 1958 ... President Eisenhower signed bill creating the National Aeronautics & Space Administration (NASA).

1 October 1958 ... NASA began official operations.

21 October 1958 ... NASA announced a competition for a manned spacecraft to be launched by an Atlas, planned to orbit around the earth and return safely. A McDonnell team which had been working on the project since January 1957 started under extremely restricted budget until assigned to prepare the proposal.

12 January 1959

... NASA announced selection of McDonnell to build Mercury spacecraft.

13 February 1959 ... Contract was signed between NASA and McDonnell for the design and construction of 12 advanced orbital Mercury spacecraft. As the program expanded, subsequent orders were received for eight additional spacecraft, two for ground training, three for orbital flights, one for post-flight check-out, transfers and made of the post-launch operation at Cape Canaveral, including the mating of the spacecraft to the launch vehicle, check out and countdown.

9 April 1959 ... NASA announced names of the seven Mercury Astronauts.

9 September 1959 ... NASA announced "Big Joe" R & D spacecraft launched to test basic Mercury design concepts. Spacecraft survived high heat and explosion and was recovered.

25 January 1960 ... Launch a year after beginning of contract, McDonnell delivered first production spacecraft (01).

3 April 1960 ... First uncrewed spaceflight (01), with escape power, launched 10 May by McDonnell.

9 May 1960 ... "Big Joe" R & D Spacecraft (01) was recovered from the ocean in an off-the-coast abort storage rocket.

29 July 1960 ... Mercury-Atlas 1. The first Atlas-launched flight was aimed at qualifying the propulsion system for orbital flights and also to study heating due to re-entry conditions. Spacecraft (01) carried no engine system or life support. Test equipment was not activated due to launch system malfunctions.

4 October 1960 ... Little Joe 1 fired at NASA's Wallops Station. Unchecked launching of launch vehicle and NASA-produced spacecraft. The Little Joe 1 team was unable early evaluation of the spacecraft in the high altitude environment encountered problems related to low altitude.

4 November 1960 ... Little Joe 2 fired from Wallops. Evaluated low altitude abort conditions.

4 December 1960 ... Little Joe 3 fired at Wallops Station to check high altitude performance of the escape system under high altitude thermal stability "heat" load in successful flight.

21 January 1961 ... Little Joe 4 fired at Wallops to evaluate engine cut-off under high altitude thermal stability "heat" load in successful flight.

25 January 1961 ... Launch a year after beginning of contract, McDonnell delivered first production spacecraft (02).

3 April 1961 ... First uncrewed spaceflight (02), with escape power, launched 10 May by McDonnell.

9 May 1961 ... "Big Joe" R & D Spacecraft (02) was recovered from the ocean in an off-the-coast abort storage rocket.

18 February 1961 ... Mercury-Atlas 2 reached an altitude of 148 miles and ended at 13,000 mph. Flight duration was 15 minutes. During reentry, the heat shield was partially dislodged. Spacecraft (02) was recovered 1,423 mi offshore.

14 March 1961 ... Little Joe 5 at Wallops Station reported Little Joe 5 test. Spacecraft (03) was recovered but all test objectives were not met and that was concluded.

8 November 1961 ... Little Joe 6 fired from Wallops to check production spacecraft (03) with a mechanism believed to have caused the failure of the Little Joe 5 vehicle in flight. Production spacecraft separation capsule resulted in early firing of the ascent tower and loss of test objectives.

21 November 1961 ... Mercury-Atlas 3 reached an altitude of 148 miles. Emergency-launched flight. Premature engine cutoff at launch terminated the test. The emergency escape system was bypassed. Escape system was not damaged and was reactivated.

16 December 1961 ... Mercury-Atlas 4 (04) was the first American orbital flight ever made. The Redstone reached a peak altitude of 145 miles and was recovered 302 mi offshore. Spacecraft (04) is now on public display in the Smithsonian Institution.

31 January 1962 ... "Giant" (05) and "Ariane-Chimp" (06) received via space history channel. Mercury-Redstone 2 - Ham and chimpanzee (05) were recovered after reaching an altitude of 135 miles and landing 430 miles northeast. Flight duration was 15 minutes. Spacecraft (05) was recovered normally in prolonged weightless flight. "Ham" was recovered safe and well.

18 February 1962 ... Mercury-Atlas 4 reached an altitude of 148 miles and ended at 13,000 mph. Flight duration was 15 minutes. During reentry, the heat shield was partially dislodged. The spacecraft (05) was carried a McDonnell-designed "mechanical rat" designed to use oxygen and eat biscuits in the orbiter at the same rate as a man. The spacecraft was recovered after one orbit 180 miles east of Bermuda.

26 April 1962 ... Mercury-Atlas 5 was an attempt to orbit spacecraft (06) with a mechanism believed to have caused the failure of the Little Joe 5 vehicle in flight and deactivated by radio command. Spacecraft escape system functioned perfectly and spacecraft was recovered for reuse.

20 April 1962 ... Little Joe 7B reached an altitude of 148 miles. Emergency flight demonstration test. Emergency escape system (06) was reactivated by McDonnell. After three orbits, escape system was released, reentered safely to the earth and was recovered. It is significant to note that the post-mission of Project Mercury was completed with this flight. The capsule had been proven man's ability to adapt to the space environment had been demonstrated.

30 May 1962 ... Astronaut M. S. Gemini Corporation aboard Mercury-Atlas 6 (07) became the first American to orbit the earth, making 30 orbits in 22 hours and 15 minutes. Flight time was the world's record. The Redstone reached a peak altitude of 145 miles and was recovered 302 mi offshore. Spacecraft (07) is now on public display in the Smithsonian Institution.

20 June 1962 ... Mercury-Atlas 7 was a successful downrange flight by Astronaut Virgil I. "Gus" Grissom. This was the first flight with the large wings, greatly improving atmospheric observations capability. Postmission time of the first orbital flight was 141 minutes. The first water and air drop determined recovery efforts. Astronaut Grissom was recovered from the water by helicopter.

18 September 1962 ... Mercury-Atlas 8 passed the McDonnell Mercury-Redstone 3 (08) in orbit. The spacecraft (08) carried a McDonnell-designed "mechanical rat" designed to use oxygen and eat biscuits in the orbiter at the same rate as a man. The spacecraft was recovered after one orbit 180 miles east of Bermuda.

3 October 1962 ... Astronaut Walter M. Schirra, Jr., in his Sigma 7 Mercury Spacecraft (09), completed a near-perfect six-orbit flight by landing on target in the Pacific Ocean off Midway Island. Much of the mission was accomplished as drifting flight by the United States' fifth man to go into space. The mission confirmed additional knowledge about spacecraft control, space vision, and man's ability to work effectively in a prolonged weightless condition. The successful performance of Astronaut Schirra and Sigma 7 prepared the way for the planned one-day Mercury flight, and later 2-man McDonnell Gemini Spacecraft rendezvous flights. The flight was part of continuing U.S. space exploration programs.

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John Glenn
Scott Carpenter
First Mercury Safely Recovered



Mercury-Redstone
1st Flight - 20 May 1961



Mercury-Redstone
2nd Flight - 21 November 1961

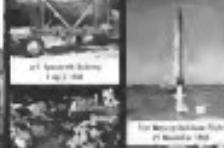


Mercury-Redstone
3rd Flight - 28 November 1961

Mercury-Redstone
Test Flight



Mercury-Redstone
4th Flight - 21 May 1962



Mercury-Redstone
5th Flight - 21 May 1962



Mercury-Redstone
6th Flight - 28 May 1962



Mercury-Redstone
7th Flight - 15 June 1962



Mercury-Redstone
8th Flight - 15 June 1962



Mercury-Redstone
9th Flight - 15 June 1962



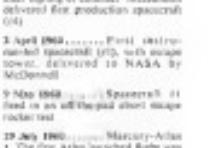
Mercury-Redstone
10th Flight - 15 June 1962



Mercury-Redstone
11th Flight - 15 June 1962



Mercury-Redstone
12th Flight - 15 June 1962



Mercury-Redstone
13th Flight - 15 June 1962



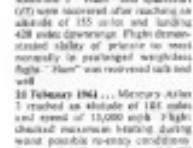
Mercury-Redstone
14th Flight - 15 June 1962



Mercury-Redstone
15th Flight - 15 June 1962



Mercury-Redstone
16th Flight - 15 June 1962



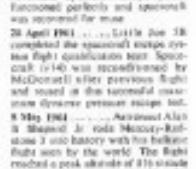
Mercury-Redstone
17th Flight - 15 June 1962



Mercury-Redstone
18th Flight - 15 June 1962



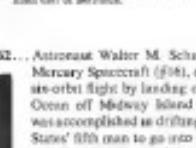
Mercury-Redstone
19th Flight - 15 June 1962



Mercury-Redstone
20th Flight - 15 June 1962



Mercury-Redstone
21st Flight - 15 June 1962



Mercury-Redstone
22nd Flight - 15 June 1962



22 November 1962 ... Space-Chimp "Enos" safely returns the ninth monkey to Earth. The chimp was the second monkey to travel around the globe, and the third to make a complete orbit.

26 February 1962 ... Three years and 27 days after Mercury contract was awarded, Mercury Astronauts G. M. Cooper and L. M. Shepard, Jr. and Astronauts Virgil I. "Gus" Grissom and Edward H. White II flew into space. The flight was the first American orbital flight to be televised live. The flight was a success.

31 May 1962 ... Astronaut M. S. Gemini Corporation aboard Mercury-Atlas 6 (07) became the first American to orbit the earth, making 30 orbits in 22 hours and 15 minutes. Flight time was the world's record. The Redstone reached a peak altitude of 145 miles and was recovered 302 mi offshore. Spacecraft (07) is now on public display in the Smithsonian Institution.

20 June 1962 ... Mercury-Atlas 7 was a successful downrange flight by Astronaut Virgil I. "Gus" Grissom. This was the first flight with the large wings, greatly improving atmospheric observations capability. Postmission time of the first orbital flight was 141 minutes. The first water and air drop determined recovery efforts. Astronaut Grissom was recovered from the water by helicopter.

18 September 1962 ... Mercury-Atlas 8 passed the McDonnell Mercury-Redstone 3 (08) in orbit. The spacecraft (08) carried a McDonnell-designed "mechanical rat" designed to use oxygen and eat biscuits in the orbiter at the same rate as a man. The spacecraft was recovered after one orbit 180 miles east of Bermuda.



in open-loop spacecraft and complex check.

* Stage 2—Starting in January, 1965, SFOF is expected to be able to handle three missions simultaneously using equipment in sequential fashion. It will also be capable of supporting tests for another two missions.

Entire SFOF will be housed in a new building, construction of which was to get under way shortly, according to Marshall Johnson, who heads space flight systems here. About \$2.5 million in NASA funds and \$1.5 million is contracted for SFOF. It will be used to make experiments in one or a full or part-time basis of the large pool of scientific and engineering talent at the laboratory.

SFOF Functions

SFOF operations will divide into three functions for which there is an executive-type of programming plan. These are:

- **Spacecraft Performance Analysis.** This involves above the rates of spacecraft power, temperature, attitude, control, communications and other parameters, and the evaluation of any anomalies.
- **Flight Path Analysis.** Determination of orbits and computation of accuracies in the basis of Doppler and range-tracking data.
- **Space Sciences Analysis.** Reduction and comparison of scientific data obtained from the spacecraft.

There are a number of separate programs to each function, all controlled by the executive program. This arrangement will permit the subdivision or addition of individual programs without changing the entire program.

Engineering testing, these functions will be separated into three areas on the main floor of the 70-ft-deep test chamber. The flight path analysis will be located in the rear floor of the main floor of the test chamber and output data to the computer.

Heart of the data processing gear in SFOF will be the laboratory's own IBM 7094 computer system, which will be updated into 7094A version so that they can compare older IBM 7094 units with the 7094A, which will be employed the older version as a backup. Ultimately both will operate in parallel systems in SFOF.

An indication of the arrangement block diagram (see p. 65) of the stage one setup. Data processing will consist of two 7094s and 12 IBM 1626 disk drives, 100-kilowatt tape drives, 100-kilowatt and 100-kilobit data tape. The tape drives feed SFOF with the DSN status, and with the Caps, through which it sends tracking data from downrange stations.

Radar reference and tracking data are fed into 7094A data channels which put data into a form usable in a pair of IBM 7094 computer systems. The last six machines mentioned later in year 1965 probably will be the first of



ORGANIZATIONAL CHART of planned components of new Space Flight Operations Facility being built at Jet Propulsion Laboratory indicates relations of Deep Space Test Manager and principal technical analysis teams to space flight project managers.

that type delivered to any instance, will serve as input-output processor, or data writer. Compared with the 7094 system, the 7094A has greater sorting and storage capability, but is slower and has less arithmetic capability.

Radar data can be transmitted from the 7094 through a disk file created by 1000 disk files for storage and to the 7094A automatically to two 7094A for processing. The 7094 will accept or store data from seven remote-hosted sites, four remote terminals located close to the 7094, and two 7094A sites obtained from remote operators in SFOF. All of the remote sites originating in the remote console are IBM 1626 disk units, the 7094A has a

1626 disk unit. Information routed through the 7094 into the 7094A can be exchanged to the 7094 input-output processor for radar reference in the communications links in addition to its processed data for storage in the 7094A disk files.

The 7094 is a short-term, short duration, mission-oriented system designed to support the data processing needs of the SFOF. The 7094A is a long-term, continuous, mission-oriented system designed to support the data processing needs of the SFOF.

The 7094 is a short-term, short duration, mission-oriented system designed to support the data processing needs of the SFOF. The 7094A is a long-term, continuous, mission-oriented system designed to support the data processing needs of the SFOF.

On-line information will be read out sequentially by random-access pointers and memory pointers (serial memory) in SFOF.

Remote input-output consists of unique information for the data flow. The data and administrative pointers at the two levels will point, as required, to local



What militarized recorder can capture all the noise in the air up to 4 Mc?

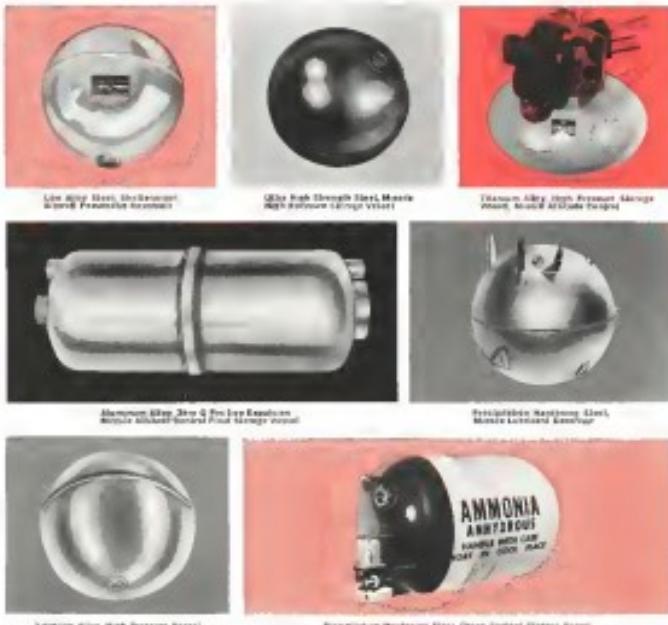
AMPEX FR-800

Meet the FR-800—the wideband recorder that offers greater performance, greater reliability. With this advanced recorder/reproducer you can capture two tracks of radar data. Or record both radar data and a picture. All without radio frequency interference. The FR-800 has a specially plated glass cover to meet RFI spec MIL I-26600, class 3. In fact, every component has been made to military specifications. Every circuit designed for military reliability require-



ments. You can mount the FR-800 in a subassembly. Use it for radar reconnaissance, radar tracking, pre-detection, communication monitoring—any application covering the frequency range of 10 cps to 4 Mc! You'll find it convenient to operate. Want more data? Write the only company providing recorders, tape and memory devices for every application. Amplex Corporation, 934 Charter St., Redwood City, Calif. Worldwide sales and service.





POP-PROOF BOTTLES

The space age has a new language all its own. In it may we add *Pop-Proof Bottles* (pressure vessels). UAP builds them for any fluid or gas pressure requirement. Their storage capabilities range from -420°F . to $+300^{\circ}\text{F}$. They're lightweight, compact, and amazingly strong—never pop and never burst you might say. UAP can fabricate Pop-Proof Bottles from aluminum alloys, low strength steels, precipitation hardening steels, ultra high strength steels, and titanium alloys.

Most PVB's are presently being designed for missiles and space vehicles. However, UAP's pressure vessel experience extends to 1945 when we first

manufactured aircraft mounted accumulators, later get engine mounted on tanks and other fluid reservoirs. Today virtually every high speed military aircraft has a UAP fluid-carrying reservoir aboard! For more details, write or phone 224-3841. UAP means United Aircraft Products Since 1929, a dynamic, independent company at Dayton, Ohio. A name to remember when it comes to pressure vessels—outstanding specialists in pressure vessels.



FILTER CENTER

► **Plasma Ring Effects Study**—Investigation to determine effects of nuclear engine produced plasma on man-made magnetic instrumentation and drift tube systems is planned by Radio & Space Development Center Program is to make integration of various simulation control techniques such as flame spraying, electron sputtering, and flame shot coating. Qualified contractors should contact Code RAKS.

► **Nearby Photo Acquire**—Photovoltaic Barriers in calling for proposals for design and fabrication of an airframe camera for staring and rapid retrieval of weather photos obtained from Nuclear astrophysical satellite under RFP-161. Proposals are due Dec. 7.

► **Apollo Guidance Computer**—General computer for the Apollo spacecraft will incorporate several technological advances including the use of monolithic integrated circuits and a core memory. The microcircuits will be employed as solid circuits because of their inherent reliability, small size and low power consumption. Both a core memory, the most dense type of memory available, presently available, and a ferrite core memory will be employed. The latter will serve as a constraint of way of storing volatile information. The computer, being developed by Massachusetts Institute of Technology as part of an Apollo guidance and navigation system responsibility, will be fabricated by Raytheon Co.

► **New Interplanetary Probe Gets Go-Ahead**—Probe for International Outer Solar System, previously called PIO-2 (AVW Aug. 13, p. 23), will be developed by National Aeronautics and Space Administration for 100,000°K temperature environment to be used in development of Apollo spacecraft.

► **Microsat**, Inc., South Pasadena, Calif., \$145,393 contract from National Aeronautics and Space Administration for 100,000°K temperature environment to be used in development of Apollo spacecraft.

► **Computer Control and Instrumentation Corp.**, Defense Product Div., Clinton, N.J., \$534,743, a two-year task. Study Review of Steps for automating surface launch radar systems to detect and locate surface targets.

► **Superspace Laser**—An unusually powerful laser theoretically capable of producing 1,000 megawatts peak power for a brief interval of less than a nanosecond has been demonstrated at the 4-power plant in being developed at General Motors Defense Research Laboratories in Santa Barbara, Calif. A ruby optical cavity with a new mirror cladding arrangement is employed. Total energy output is expected to be about one pulse. The concept will be described at a forthcoming meeting of the American Physical Society.

► **Mass Superspace Rhythm Detachable Opticule**—of the superspace

electron tube research and development contract being conducted by Technical McDonnell for Space and Defense Test Center (AVW Aug. 13, p. 31-32). This year's high-vacuum tube will be advanced current tube technology at this frequency. Specifications include peak power maximums of 1.0 mev and maximum of 100 mev, a maximum of 100 kva, and perhaps as high as 1 mev, average power at a center frequency of 8.8 mev, a bandwidth of at least 4.5% and efficiency of 30% over mean and 50% at the final grid. Pulse length capability is to be a minimum of 20 nanoseconds and gain is to be a minimum of 15 db, with 35 db at final grid. Fabrication of three engineering models of the tube is to be completed in mid-1969.

► **Signed on the Dotted Line**—Major contract awards recently announced by various organizations include:

► **Marshall Standard Division of United Aircraft Corp.** will develop automation techniques for interconnecting and packaging solid state semiconductor and thin film microcircuits into functional packages. The technique, known as wire bonding, will use film deposition techniques under a \$240,000 study contract awarded by USAF's Aerospace Test Systems Division.

► **Malloy, Inc., Falls Church, Va.**, \$3.9 million firmwide study contract from Army for a forward-area electronic intelligence solution to be used for electromagnetic reconnaissance.

► **Microtek, Inc., South Pasadena, Calif.**, \$145,393 contract from National Aeronautics and Space Administration for 100,000°K temperature environment to be used in development of Apollo spacecraft.

► **Computer Control and Instrumentation Corp.**, Defense Product Div., Clinton, N.J., \$534,743, a two-year task. Study Review of Steps for automating surface launch radar systems to detect and locate surface targets.

► **Colden Radio Co.**, three USAF contracts totaling more than \$1.1 million for mobile radio transmitters, airborne communication and navigation gear and for microwave heating systems.

► **Atm, Inc., Raleigh, N.C.**, \$54,905 contract from NASA to conduct preliminary parametric study of space atmospheric plasma in the 3.3 to 30 kev range using low temperature working fluid.

► **Electro-Optical Systems, Inc., Fairmont, Calif.**, \$67,615 award from Jet Propulsion Laboratory to develop and produce fire protection switch of an insurance classifier to be used to measure Von Mises resistance about flamer spallation.

NEW FLEXIBLE PERMANENT SEALANT



GENERAL ELECTRIC

- seal metal parts
- seal bonds
- withstand heat
- withstand cold
- withstand shear
- withstand vibration
- withstand solvents

For a free sample, just write or wire us on how it's to be used. No pre-ordering or pricing. RTV-102 is a flexible, permanent, non-curing, one-part sealant—glue, epoxy, plastic, foil, wood, silicon rubber. Seal as many as 1000 joints in a few hours. It's safe to handle, easy to apply, no fumes, no odors, no evaporation. Resists moisture, grease, weathering, many chemicals, and temperatures from -196°C to 500°F .

RTV-102 doesn't sag on vertical surfaces, can be smoothed with a large brush, "wicks" with vibration and flexing. For free evaluation samples and technical data, write or wire Interchemical Corp., Dept. AVW, 300 Park Avenue, New York, N.Y. 10022. Your Product Department, General Electric Company, Westford, Mass.

GENERAL ELECTRIC



**LSI provides
the key to your space
and defense systems
requirements**

SPACE VEHICLES

Communications. Command control.
Test program planning. Antennas. Attitude control.

MISSILES

Tracking systems. Gyroscopes and platforms.
Autopilots. Radar motor cases.

AIRCRAFT SYSTEMS

An LSI product can be found in almost every
aircraft flying today.

UNDERSEA WARFARE

Launch, steering and diving controls. Control module
for DASH - (Destroyer, Anti Submarine Helicopter).

POWER EQUIPMENT

VISCF (Variable Speed Constant Frequency) drive.
Starters and generators. Magnetic particle clutches.

COMMUNICATIONS EQUIPMENT

Video systems. TV cameras for use at sea, on
launched pods, battlefield surveillance.
Dish beams for moving down personnel.
Monitoring and transfer controls for TACAN.

GROUND SUPPORT EQUIPMENT AND INSTRUMENTATION

Launch control. Telemetry checkout and recording
systems. Meteorological systems and radar.

RESEARCH AND DEVELOPMENT LABORATORIES

Thin film microcircuitry. Electroluminescence.
Life sciences, cryogenics and lasers.

SERVICE

Aerospace maintenance and overhaul system
checkout. Worldwide facility maintenance.

*LSI - where the future happens faster - due to
talent, facilities, and financial soundness.*

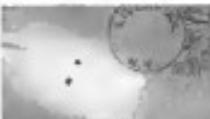


LEAR SIEGLER, INC.
SANTA MONICA, CALIFORNIA

NEW AVIONIC PRODUCTS



Stable crystal frequency standard. Model 1010M has long-term stability of five parts in 10 billion per day, with short-term stability of five parts in 10⁸. Yokan based in a vacuum-sealed, temperature-controlled environment, according to manufacturer. The new timer provides V/F and output of extreme spectral purity as well as outputs of 10 Hz and 1 ppm. Unit is designed for medical, monitoring and control at 4.75-4.77 GHz, designed to seven weeks. Systech Inc., designer of the 1010M, without a F/F ratio output, is priced at \$2,500. Manufacturer: Cray, Systech Corp., San Gabriel, Calif.



Positioned micro-thermometers. Silicon plasma and plasma-coated sensors of 11 conventional military and industrial types are priced at \$6 to \$17 in quantities. Thin-film polycrystalline silicon on a Kovar substrate 0.07 in. wide and up to 10 in. long, then encapsulated with an epoxy resin. Semiconductor system is surface passivated with when needed to protect from kinetic and/or thermal. Manufacturer: General Electric Co., Semiconductors Products Dept.



S-band backward-wave oscillator. Type SWB-400, with integral permanent focusing magnet, has output power of 100 mW, minimum from 2.0-4.0 GHz. Frequency can be swept over the full band by varying drive line voltage from 150 to 1,410 V. Manufacturer: Monolithic Microwave Electronics Inc., Buffalo, N.Y.

app from 150 to 1,410 V. Also available is SWB-75, a derivative for use in aircraft and missile. Manufacturer: Schenck Electro Products Inc., 1160 Main St., Buffalo, N.Y.

- **Microwave displacement goniometer.** Two digits of resolution, weighing less than 1 lb., is designed for use in spring-driven or beam-balanced systems. It features a beam deflection of 0.05 deg during 15sec. with no more than 140 sec. settling time. Total mass is 1.4 lb. including base and 0.7 lb. drift at 15 sec. rate in a 3-oz. tilt table, also, according to manufacturer. Goni, which accuracy is 2 arc sec. at 1 sec. time, has 70-deg of total freedom, uses potentiometer pick-off. Angular resolution of 150,000 rpm can exceed 10 sec. and is developed in 70 milliseconds. Spring time: Manufacturer: Clevco, Shewman Corp., San Gabriel, Calif.



- **Thermoelectric controller.** Model 1700, maintains temperature to $\pm 2^\circ\text{C}$ in a chamber within one degree of any desired temperature between 0.01G, Inc. unit, with solid-state components and frequency standards. Thermocontroller includes self-capability for stability, redundancy and self-limiting cooling.

- **Cryogenic linear, solid-state driver.** Unit at temperatures as low as -196°C , provides time intervals from 0.05 to 3 sec, adjustable by changing an external timing resistor, and operates from 20-32 Vdc. Tracey encapsulated in rigid polyurethane foam measures 1 x 1 x 1.1 in. and weighs 0.13 lb. Manufacturer: Tracey Instruments, Inc., Flushing, L.I., N.Y.

CAREER OPPORTUNITIES IN THE 5 AREAS OF DALMO VICTOR SYSTEM CAPABILITIES

The digitized environment in which the Dalmo Victor system operates challenges Dalmo Victor's engineers to invent creative ways of approaching other career opportunities in areas of vision, imagination and ability.

1. AIRBORNE ANTENNAE: Required for the successful operation of tactical and strategic weapons systems. Complete, high performance antenna packages for both fixed and track, surface-to-air, ground mapping, fire control and a broad range of other projects.

2. AEROSPACE PROGRAM SYSTEMS: Mission-critical flight management and navigation systems provide tracking and control features for vehicles ranging from space penetrators. Dalmo Victor has the capability of producing complete complexes, from basic design to execution.

3. MICROWAVE SYSTEMS: Dalmo Victor has been deeply involved in microwave systems for many years. Leadership has been exercised in telemetry, advanced tracking, communications and distance measuring, with capability for satellite communications and solid-state ionospheric sounding.

4. MAGNETIC SYSTEMS: Another Dalmo Victor advanced area, involving such unique developments as solid-state magnetic vehicle location systems, space vehicle orientation and attitude control systems, and magnetic sensors in magnetic and in related fields.

5. GROUND SUPPORT EQUIPMENT: In collaboration with California Testcenter in Anaheim, another Dalmo Victor company, Dalmo Victor supplies a wide range of ground support and general environmental equipment. From a high-affective contamination of 100,000 RHD termill, Dalmo Victor provides heated single source responsibility.



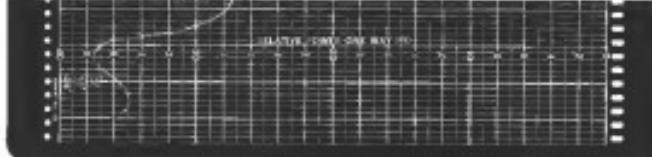
DALMO VICTOR BACKSTOPS NATO'S F-104 WITH GROUND SUPPORT EQUIPMENT

How do you keep a computer weapons-system in fighting trim? How do you check out the myriad of circuits in the avionic systems and sub-systems in a multi-role all weather aircraft as NATO's Lockheed F-104? DV does its part with automated equipment such as this NASARR Pattern and Bore sight Set—one of several checkout units designed and manufactured by DV for Autometrics, a division of North American Aviation, Inc., F-104 NASARR systems contractor. □ This design philosophy used in Dalmo Victor's ground support equipment stresses simplicity, operational

reliability and ruggedness with correlative type construction. From operating instructions to layout, everything is designed for operational use. □ This ground support equipment is another example of Dalmo Victor's integrated systems capability. DV is in the van guard of new developments in its major product areas. If you are interested in becoming part of these challenging programs, Dalmo Victor currently is involving applications from qualified scientists and engineers. For information contact Director, Scientific and Engineering Personnel.

DALMO VICTOR COMPANY

1020 INDUSTRIAL WAY, BELLSPORT, CALIF. A SUBSIDIARY COMPANY





This new Sanborn/Kappa Model 2020 system conforms to accepted IEC/CCIR recommendations, including a noise level of 15 dB, an accuracy of 0.05%, and a bandwidth of 100,000 cps with distortion less than 10,000 cps. FM wavelength: 1400 m. Note that the non-linearity is only $\pm 0.5\%$ on IDC, $\pm 1\%$ on AC.

Basic system features include quality long-head, readily accessible printed circuit plug-in modules; basic compensation by using one shared or independent all output alignment of all FM channels with built-in mixer and detector module; eliminating need for electronic memory; automatic search circuit; entire system at only 31 $\frac{1}{2}$ inches wide; packaging in either mobile console shown or portable cases for tape transports and discriminators.

System price of \$20,000 includes 7 channel tape transports, cassette change, playback preamplifier, power supply and 7 channels of FM Record/Reproduce electronics, housed in mobile switch cabinet. All after F.O.B. Waltham, Mass., and subject to change without notice.

Get the complete specifications on this new Tape System — as well as 5 new types of Sanborn Data Amplifiers, 117 Multi-Tube Scope and other related instrumentation — from your local Sanborn Industrial Sales-Engineering Representative. Ask him for your copy of the complete Industrial Catalog.

INDUSTRIAL DIVISION
SANBORN COMPANY
WALTHAM, MASS.
An Affiliate of Standard-Kappa in Germany



NEW AVIONIC PRODUCTS



* Photoelectric digital code converter, Model 190, can convert 32 characters per second to any 7-bit code by installing appropriate coded disks. Code disks convert up to 128 characters with parallel bit serial character conversion. Device weighs 71 lb., 75 in. high, 9 in. wide, 9 lb., and operates from 117 v.a.c. Manufacturer: Texas Corp., 26 Fox Road, Waltham, MA, Mass.

* Micro shift register, angle-bit range type packaged in TO-50 can, operates at 50 new peak power per shift register for a pulse duration of two microseconds and acquires one power as steady. Operating frequency of the micro shift register device is 0.200 kc, and operating temperature range is -55°C to 100°C. Manufacturer: C&K Components, 105 Main St., Newton, MA, Mass.



* Digital pressure transducer, Model PDS, converts pressure measurements into a seven-bit unidirectional binary code pending insulation to 128 discrete parts. Transducer is available to measure pressure from 0.1 psi through 0.1,000 psi absolute, and gas and differential. Transducer, with dimensions of 14 in. dia. x 9 in. long, operates in a temperature range of -65°F to 219°F. Connected waveforms show resolution to less than 1% full scale, according to manufacturer. Manufacturer: Instruments, Inc., 12461 W. Olympic Blvd., Los Angeles, Calif.

PROBLEMATICAL RECREATIONS 146



Two squares are covered from opposite corners of a checkerboard leaving 62 squares. Can the checkerboard be filled with 31 dominos, each domino covering two adjacent squares?

—Concluded

A good move for digital computer users would be to contact our Guidance and Control Systems Division, Specialty Mt. F. Lucy. While in his sleep position now open in connection with our airborne digital computers including general and special purpose machines, digital differential analyzers, and digital data processing equipment. Simply mail your name and let Mr. Lucy tell you. He handles all-digit numbers rather nicely.

ANSWER TO LAST WEEK'S PUZZLE: 15886

An Expert Gymnast and a Kayaker

LITTON SYSTEMS, INC.
Guidance & Control Systems Division
Woodland Hills, California



REPUBLIC AVIATION CORPORATION SPECIFIES

RESEARCH COTTRILL POWER SUPPLIES FOR SPACE ENGINE RESEARCH
At Rocketdyne's Plasma Propulsion Laboratory, engineers and scientists are harnessing electric energy to create plasma engines for future space vehicles.

The aerospace division of the Research-Cottrell Corp. provided the power source for the first plasma energy source to be used in a space vehicle. The 100-kilowatt plasma energy source, developed by the company's Research-Cottrell Division, will be used to power the plasma engines of the experimental space vehicles.

Research-Cottrell custom designs high voltage DC power supplies, transformers and control systems for many installations or research applications. Its principal application is Rocketdyne's plasma engine development program.

Research-Cottrell custom designs high voltage DC power supplies, transformers and control systems for many installations or research applications. Its principal application is Rocketdyne's plasma engine development program.

ALLOY NOMENCLATURE

1. Table I—Nomenclature of Aluminum Powder Metallurgy Alloys

Alloy	Old Designation	APM
XAP001	6051-T7	6
XAP002	6061 & 6066	8
XAP003	6061-T6	11
XAP004	6063	15
XAP005	—	6

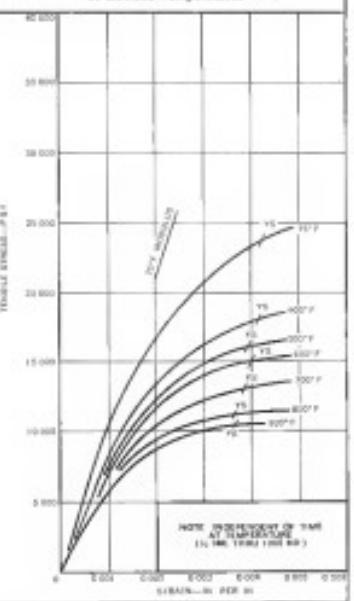
Alcoa capability at work...**guaranteed properties up to****3. Table II—XAP001 Extrusions, Maximum Mechanical Properties**

ROOM TEMPERATURE	
Longitudinal	Transverse
Ultimate Strength, Psi Yield Strength, Psi Elongation % or 0.02	73,000 73,000 7
Longitudinal	Transverse
Ultimate Strength, Psi Yield Strength, Psi Elongation % or 0.02	73,000 73,000 7
Longitudinal	Transverse
Ultimate Strength, Psi Yield Strength, Psi Elongation % or 0.02	73,000 73,000 7

4. Table IV—Physical Properties of Alcoa's APM Alloys

	XAP001	XAP002	XAP003	XAP004	XAP005
Specific Gravity	2.71	2.71	2.71	2.71	2.71
Density in gm/cm ³	2.71	2.71	2.71	2.71	2.71
Electrical Conductivity	0.0085	0.0085	0.0085	0.0085	0.0085
Thermal Conductivity (at 20°C, W/cm °K)	0.17	0.17	0.17	0.17	0.17
CoP (1000)	63.07	63.07	63.07	63.07	63.07
Electrical Resistivity (at 20°C, ohm cm)	0.045	0.045	0.045	0.045	0.045
Heat of Combustion (Calories/gm)	930.0	930.0	930.0	930.0	930.0
Heat of Fusion (Calories/gm)	100.0	100.0	100.0	100.0	100.0
Specific Heat (100°F)	0.093	0.093	0.093	0.093	0.093
Specific Heat (20°C)	0.093	0.093	0.093	0.093	0.093
Thermal Expansion per °F (100°F)	18.000	12.0	21.8	15.3	15.1
Tensile Modulus (100°F)	21.7	21.7	21.7	21.7	21.7
Young's Modulus (100°F)	13.7	13.7	12.9	12.9	12.9
Melting Point (°C)	617.0	617.0	617.0	617.0	617.0
Boiling Point (°C)	640.0	640.0	640.0	640.0	640.0
Specific Heat (100°F)	0.093	0.093	0.093	0.093	0.093
Specific Heat (20°C)	0.093	0.093	0.093	0.093	0.093
Thermal Conductivity (at 20°C, W/cm °K)	0.17	0.17	0.17	0.17	0.17
Electrical Resistivity (at 20°C, ohm cm)	0.045	0.045	0.045	0.045	0.045
Heat of Combustion (Calories/gm)	930.0	930.0	930.0	930.0	930.0
Heat of Fusion (Calories/gm)	100.0	100.0	100.0	100.0	100.0
Specific Gravity	2.71	2.71	2.71	2.71	2.71
Density in gm/cm ³	2.71	2.71	2.71	2.71	2.71
Electrical Conductivity	0.0085	0.0085	0.0085	0.0085	0.0085
Thermal Conductivity (at 20°C, W/cm °K)	0.17	0.17	0.17	0.17	0.17
CoP (1000)	63.07	63.07	63.07	63.07	63.07
Electrical Resistivity (at 20°C, ohm cm)	0.045	0.045	0.045	0.045	0.045
Heat of Combustion (Calories/gm)	930.0	930.0	930.0	930.0	930.0
Heat of Fusion (Calories/gm)	100.0	100.0	100.0	100.0	100.0
Specific Gravity	2.71	2.71	2.71	2.71	2.71
Density in gm/cm ³	2.71	2.71	2.71	2.71	2.71
Electrical Conductivity	0.0085	0.0085	0.0085	0.0085	0.0085
Thermal Conductivity (at 20°C, W/cm °K)	0.17	0.17	0.17	0.17	0.17
CoP (1000)	63.07	63.07	63.07	63.07	63.07
Electrical Resistivity (at 20°C, ohm cm)	0.045	0.045	0.045	0.045	0.045
Heat of Combustion (Calories/gm)	930.0	930.0	930.0	930.0	930.0
Heat of Fusion (Calories/gm)	100.0	100.0	100.0	100.0	100.0

Temperature at Alcoa Research Laboratories is 600°F (320°C). XAP001 and XAP002 plots show that these alloys have a T_g of 270°. Below as much drawing capacity as other base metals more strain is lost. Alcoa products can exhibit unusually high drawing capacity.

5. Tensile Stress—Strain Curves for Alloy XAP001 at Elevated Temperatures

APM PRODUCTS

2. Table II—APM Product Chart

Alloy	Sheet	Plate	Forgings	Impact Extrusions	Estimated Strength	Round Rods	Barrels
XAP001	X	X	X	X	X	X	X
XAP002	X	X	X	X	X	X	X
XAP003	X	X	X	X	X	X	X
XAP004	—	—	—	X	X	X	X
XAP005	X	X	X	X	X	X	X

X—Products have been fabricated on a production or experimental basis

900°F for an aluminum alloy

Alcoa research has developed a series of new high-temperature (600°F to 1,000°F) alloys made from aluminum powder. These remarkable Aluminum Powder Metallurgy (APM) Alloys have higher mechanical properties at these temperatures than any other aluminum alloy.

Alcoa's Aluminum Powder Metallurgy Alloys also exhibit several other attractive characteristics including:

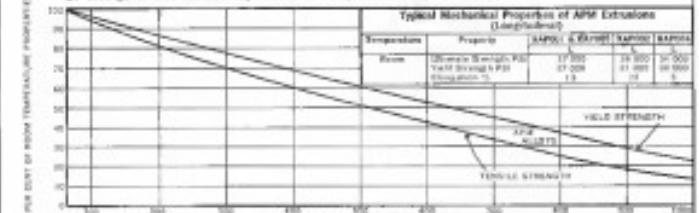
1. Small grain size at elevated temperatures regardless of the length of exposure time at temperature.
2. Retention of desired room temperature properties and dimensions after repeated elevated temperature exposure.
3. High modulus of elasticity at both room and elevated temperatures.
4. Strength without heat treatment. All APM alloys are used in the as-fabricated condition.
5. Low weight, greater cross-section and rapid decay of residual temperature.

Take Alloy XAP001 for example. Check its maximum mechanical properties in Table I reproduced from Alcoa's Development Division Report. (This is the first time maximum guaranteed properties have ever been published for any aluminum alloy at temperatures up to and including 900°F.) In addition, XAP001 has extensive resistance to creep. It has been ultrasonically spot welded, flash-butt welded and electron beam welded to itself and other aluminum alloys. Alloy® Aluminum XAP001 can be spun, machined with a minimum of tool wear, and formed by rolling, extruding, forging, stamping, plates, cups, cones and sheets—virtually as for present-day applications on any of these items. Consider APM alloys for such applications as resistor wire components, valves, pistons, piston rings, hydraulic and braking equipment, and engine accessories.

XAP001 exhibits mechanical properties similar to XAP001 heat-treated aluminum at 600°F.

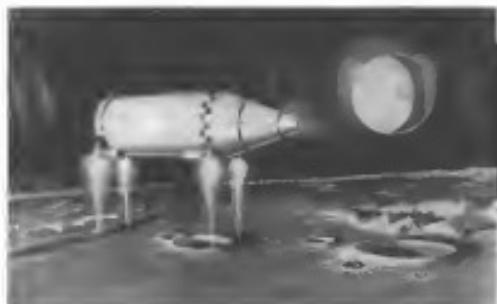
Through extensive design information on XAP001, as well as on APM alloys XAP002, XAP003, XAP004, and XAP005, is already available. Alcoa will continue, as always, to investigate new APM alloys, new processes and improvements. Please keep in touch with us for further information.

Note: Graphs and data shown here were not compiled from special samples but are the results of many production runs.

6. Change of Mechanical Properties with Temperature—APM Extrusions**send the coupon**

Aluminum Company of America,
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LUNAR HOUSING UNIT, part of Douglas-proposed system for lunar surface station, is shown in the after's recovery pod before landing on the moon's surface.

Assembly, Placement of Lunar

By David A. Anderson

Los Angeles—Problems of lunar assembly, logistics and support received detailed attention at the recent 17th annual meeting of the American Rocket Society here (AW Nov. 19, p. 21).

There is general agreement among space scientists that lunar operations, after the first approaches by Apollo craft, will depend on some form of shelter on the lunar surface. Not only does this shelter furnish protection against the hostile environment but it also provides the valuable opportunity of a mobile laboratory. To sustain an existing effort, further, if the present tally of such actions were lost due to technical failures, nonetheless, the shelter should be able to serve as a survival element until replacement could be effected.

Current approaches focus on three ways of accomplishing this: full-scale manual implementation of a shelter by robot vehicle-mounted crews; and employment of the more-experienced astronauts and engineers.

These three approaches, it is noted, bring one or more major difficulties along with them. One difficulty, for example, is how to assemble a habitat module in space. This meeting saw described by Dr. C. William Heyman, a government architect working at Douglas Aircraft Co., Los Angeles Space and Information Systems Division:

the more difficult qualify control shift in the module.

One of the specific examples Heyman used to prove the difficulty of manual operation occurred during a space maneuvering program planned partly in Rockwell and NASA earlier this year. One of the goals was to evaluate at many different positions both as possible during the two days available for the program—in fact, at least all the time was spent evaluating just one site.

One problem to be performed by a subject in a full pressure suit involved the removal and replacement of a small

Tetrahedron Satellite

Tetrahedron-shaped satellite weighing 11 lb. and riding payload shroud in Air Force Titan Atlas boosted into orbit in March was placed in orbit recently to measure damage to solar cells from the Van Allen radiation belt. Launch took place from Vandenberg AFB, Calif.

Air Force announcement of the use of artificial sun and its position of one of these active satellites from Space Technology Laboratories for the project of measuring radiation in space resulted in Aviation Week report on the program (June 18, p. 125).

Promised-shaped satellite, measuring 6.5 in. on an edge, uses 20 solar cells and transmitters which send data back for three months. The satellites cost \$25,000 each, plus engineering development and launch; have a maximum lifetime of 90 days and are powered by solar cells.

Heyman emphasized the problem of structural construction on the moon, and stated that for the immediate future, design should be guided by the largest available components that can be launched from earth. The most economical approach is structural assembly on the



DOUGLAS-PROPOSED SHELTER (left) is covered with heat and shield by reflector panels to give protection against environmental extremes. Operations would be controlled from earth by television and telemetry. TV camera is mounted on vehicle. North American laser-boring concept (right) has underground hab center made of electron-beam-tracked concrete rings. Other rings are closed-coupling heat exchanger and dry food production also contain carbon dioxide-oxygen converter and dehydrator for biological supplies.

Surface Shelter Outlined in ARS Reports

duct fastened with 17 nuts and washers. It took 90 men to complete the job, which was estimated to require 10 men for an unskilled worker. Great improvements in the soil were made, however, by applying the correct technique. Some of these were non-contractors. Personnel digging from the side, when forced into the lower lip of the helix, became fatigued, causing incomplete digging.

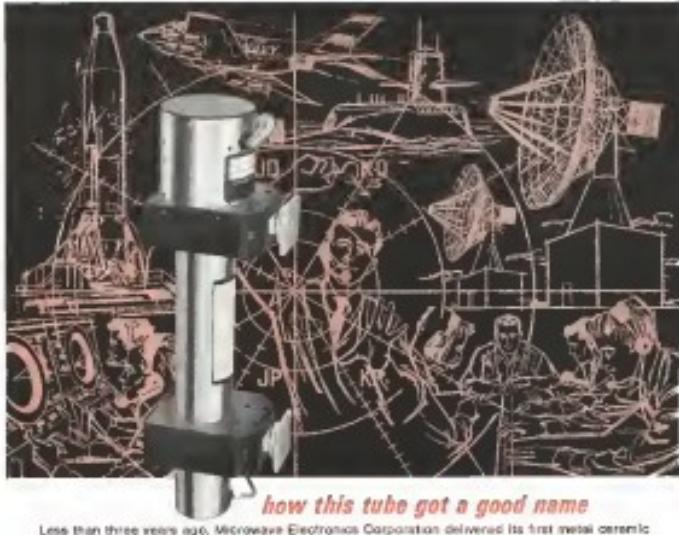
Second estimates were 6 hr., to remove and replace a gas generator spark plug housing never previously accomplished in the pressurized vehicles. Estimate was that the unskilled had to knock the mud with bare hands to get at the bushes—the required enthusiasm and strong effort is the vital. After seven attempts of trying to reach and raise Allen head bolts, one solved way by per se sterilizing and had to be removed from the van.

Heyman's presentation also described a robot vehicle stored and carried in the moon in the landing stage of a typical capsule, which could be separated from earth by a combination of vibration and impacts, to complete the landing stage. The robot would dig into the lunar surface and mark the area around the landing stage for shelter.

With the robot believed available on the moon in the rock universe, can be estimated by presenting means that will be effective for such tasks will for those who are in a relatively short time, said Bruce B. Carr, Caltech Chairman. That to produce 5 lb. of ice for oxygen would weigh 7.5 tons, including the ice-making power plant.



WATER-CONVERSION PLANT is modeled in North American Aviation concept. Capsule carries a freeze-drier which volatiles can be frozen and preserved in freeze dryer. By melting the rock and then heating it, rock studies can be used for extraction processes after water has been recovered.



how this tube got a good name

Less than three years ago, Microwave Electronics Corporation delivered its first metal ceramic traveling wave tube. Today MEC has a broader line of metal ceramic TWT's in field operation than anyone else, including some of the biggest companies in the electronics industry. Why has MEC been so rapidly accepted by military systems designers, the military itself, and industrial instrument and system builders? 1 Because MEC tubes work when the customer gets them. MEC has one of the highest acceptance rates in the industry. 2 Because MEC tubes operate longer. Users report 4,000 to 6,000 hours field life, our own life tests exceed 10,000 hours. 3 Because MEC will tackle the tough job and do them in a hurry. Any socket where there is a problem in life, reliability, or controlled characteristics. 4 Because MEC offers production tubes with truly reproducible characteristics—the result of engineering skill plus careful selection. 5 Because MEC tubes can safely critical military environments, such as MIL-E-5400 Class II. ■ Each year MEC has substantially broadened its product line in terms of frequency, power and noise figure. From R & D this year, for example, came a 200-watt pulsed power TWT, matched gain tubes in S, C, X, and K_u bands, and a high power, low noise TWT operating in X band. And, of particular note, a field operational traveling wave mixer using closed cycle refrigeration. Of these, and other developments, more later on these pages.

Excellent opportunities exist in applied microwave device engineers and scientists at MEC. Call or write Dr. Stanley F. Kassel, president for an appointment to speak personally.



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Arc Heater Simulates Spacecraft Re-entry Heat

Electric arc heating, generating 2,500 kw of power, is being used to produce air streams with temperatures of 7,000°F to test samples of heat protective materials for future space craft. Heater is located at NASA's Langley Research Center, Hampton, Va.

PRODUCTION BRIEFING

Hughes Aircraft Co. will develop and test a small conjugate electron gun for the Hughes 1000-series communications satellite. The mission is to demonstrate improvements in the antenna, heating, and power supply. Hughes Satcom's continued activities in communications.

Bethesda Instruments, Inc. has developed a spotcheck gas chromatograph for National Aeronautics and Space Administration's Manned Space Center. Called "Spectra," it costs about \$240,000. Counter流式设计, designed for use in orbit, NASA's satellite, will monitor the cloud atmosphere of the spacecraft. Total package, consisting of analyzer and pump module and below deck unit weighs 12 lb and operates on a few watts of power.

Wichita Electro Acoustic Division has been selected to build the static structure to convert fuel and human power from the air to use for the Apollo spacecraft.

Cutting Glass Works reportedly will purchase a consulting contract with Lockheed for development of a mobile vehicle separation system for the Vietnam warplane. The division also follows closely completion of a systems development program by Feltner.

high pressure

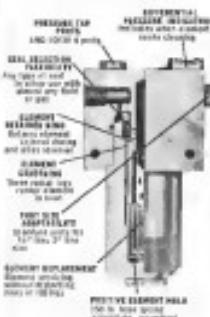
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Recoverable Camera Films ICBM Firings



RECOVERABLE CAMERA components (left) are quartz window housing, Milikan DE35/SA camera with 110-deg. field of view lens, protective housing and recovery package with drag chutes deployed. Flight configuration of the capsule is shown at bottom.



CUTAWAY VIEW shows use of fiber optics (right) travelling 300 meters through a rotating prism to expose a recoverable camera inside during flight.

Washington—Crause Laboratories' recoverable camera capsule, used for the first time in the SA-3 test to monitor Soviet proleptic action, has photographed a flight behavior of 18 Titan and Minuteman development launches.

In the SA-3 flight, right, Crause says, was satisfied above the proleptic tests in which the Star 3000 telescope was employed in order to provide a light source.

For other flights, the recoverable camera system may be used to photograph the remains of blowoff panels from the starboard consection, stage rocket firing, interstage firing, stage separation and engine ignition, and booster ascent.

Capsule System

Complete capsule consists of three sections—epoxyencapsulated, central and recovery.

The section is in the segmentation system, and in Titan and Minuteman tests was replaced by a magnetic tape model.

The camera was used for the first test launch of an Atlas vehicle to photograph booster separation (AW Oct. 26, p. 72).

Capsule is a 28.5-in. cylinder, 2.75-in. dia. Flight weight, including 100 ft of film, is 57.5 lb. Other specifications are:

- Performance—Designed for Mach 10 reentry at an altitude of 80,000 ft. Minimum dynamic pressure is 0.005 psf at a 14,000 ft. altitude. Capsule ignites at 93 sec. To the Atlas vehicle test launch, the capsule reached an apogee of 420,000 ft.

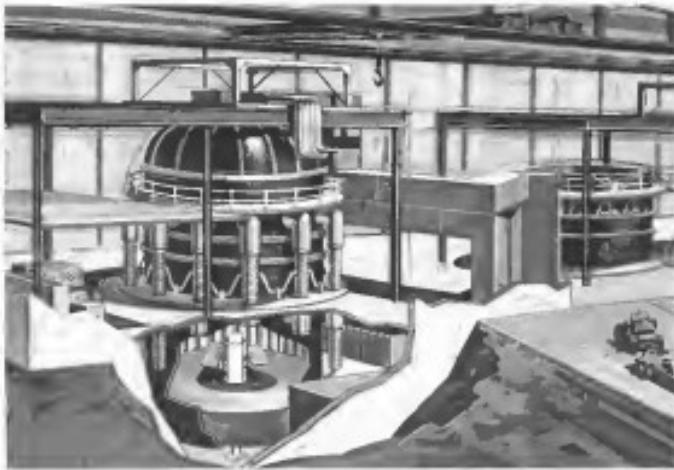
- Photographic system—In the Star 3000 application, Milikan DE35/SA camera was used with a wide-angle (110 deg.) lens; lens focal length of 300 mm; exposure was 1/2 sec., f/2.5, 100 ASA and exposure rate, 3.5 sec., 100 ASA and exposure rate, f/2.5. Film is exposed at the rate of 400 frames/sec.

- Post-ignition components—Capsule has a two-stage decelerator system. First stage consists of eight drag chutes which are deployed when the capsule leaves its launching tube. Second stage is a flotation balloon, 18-in. dia., with an equator slant parabolic, called a parabola, 37-in. dia.

- Recovery—An S-band radar shaft is ejected when the capsule is ejected. System also contains a 15-watt radio beacon, high-gain, high-gain, finding light and dry storage.

Crause said it is now developing video cameras and image television cameras for installation in the capsule.

NEW SIMULATION LAB



Nuclear submarine battles give crews realistic training on land



To ready the trained manpower necessary to operate America's first growing fleet of nuclear ballistic missile submarines, Honeywell is installing the Submarine Attack Trainer Facility at New London, Connecticut.

Designed to train for the Navy by Honeywell, the trainer incorporates a variety of the critical elements of these operational nuclear submarines. Through realistic simulation of sonar, radar and periscope contacts with the "enemy," sailors and crewmen are given valuable experience in making combat decisions.

The first floor contains three attack simulators, while on the second floor is Honeywell's 10,000 square foot digital computer room, where tactical situations to be solved by the sailors and crewmen. A command center on the third floor is created by model instructors and officers who create strategic and tactical problems and evaluate the trainees' responses.

DUPLICATES CONDITIONS OF OUTER SPACE

Honeywell chambers speed spacecraft testing with exact simulation of vacuum, temperature, solar radiation

Scheduled to go into operation next year at NASA's Goddard Space Flight Center is one of the world's most advanced space test and simulation facilities.

The new laboratory will house two giant chambers: the Space Environment Simulator (far left) and the Dynamic Test Chamber. These will provide the flexible test and evaluation capability required for flight acceptance tests of the Orbiting Astronomical Observatory. The Space

Environment Simulator will reproduce the high vacuum, temperatures and solar radiation conditions encountered in flight through outer space. The Dynamic Test Chamber will test spacecraft performance under varying air pressures.

Honeywell, as prime contractor, is responsible for design and installation of the two chambers which will permit testing and evaluation without lost time due to weather, and at a greatly reduced cost.

Entomology chamber creates controlled world for insect study

Two dogs insects flourish to return and become the meat of the life habits of insectivores are but two of many uses of a unique environmental chamber recently completed by Honeywell at its Duarne, California facility for Purdue University.

The comparative behavior chamber measures 8 x 30 x 12 feet and will be housed in the Purdue Entomological Environmental Laboratory.

Equipped with an overhead bank of fluorescent and incandescent lights, the chamber is able to simulate a typical day at which the sun goes through a complete



cycle—from sunrise to sunset). A Honeywell programming unit provides for automatic or manual control of heat, humidity, moisture and illumination conditions found throughout the world.

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SITE: A man-made quarry in Al�erion, Canada, inundated with water and plunged 34' deep.

OBJECTIVE: Test of Canadair STOL performance.

RESULTS: At full gross load, the Canadair is airborne in 23 seconds. Biplane take-off from dry concrete is 22 seconds, zero wind.

The STOL Canadair takes off in a distance of 723 feet with 3 tons of military payload.

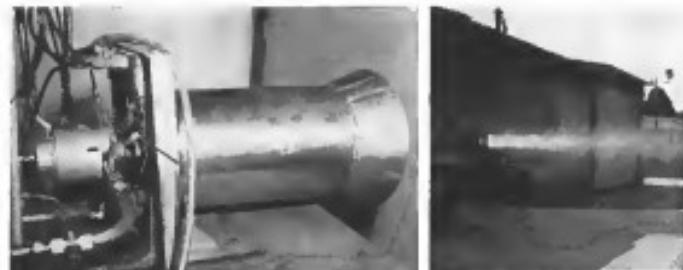
In 1960 the first test made at Port Hope site.
The aircraft shown here is not a replica.
Estimated the actual site.

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HEADQUARTERS

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ONTARIO



TD-321 COMBUSTION CHAMBER and nozzle assembly is shown, fully mounted on test stand at Thiokol's Reaction Motor Division. Uncooled engine, with a throttleable nozzle aspirator, has been tested at 254 sec. TD-321 is designed for 10,000 lb thrust at sea level. **Uncooled TD-321 developmental engine** shows fire at right.

Thiokol Fires Throttleable, Ablative Motor

Denville, N.J.—Uncooled, ablative rocket combustion chamber and nozzle assembly, with a throttleable nozzle aspirator which reduces homogeneous combustion to avoid mixing the liquid propellants has been testfired by Thiokol Reaction Motors Division here.

Alcryn, heat of the propellant grains, designed for deep space use, is fiber coated, linearly programmed, wrapped plasticite, programmed rates can be attained by varying the propellant grain density called Alcryn. It is packed axially between the liner and the outer aluminum shell.

The test firings, totaling 204 sec., have been run on the engine which Thiokol has designated TD-321. Fuel flow was a short 8-sec. rate. Second stage liquid 256 sec. Combustion efficiency, slightly under 100%, was achieved with an uncooled fuel flow ratio of two to one according to Joseph Lavigueur, project engineer. Fuel was a 1.1 mixture of UDMH and hydrazine. Oxidizer was nitrogen tetroxide. Chamber temperature reached about 5,000° F. The insulation layer of the insulation layer was hot enough to allow enginem to touch the nozzle shortly after the 356 sec. firing, he said. Chamber pressure reached a peak of 118 psi.

Throttling capability of the 70.6-lb.-engine was tested through several cycles. Lavigueur said, "We tried to switch, down to minimum and back up to maximum. Maximum thrust profile was 110 lb. and minimum was 5,300 lb. Spec rated thrust is 10,000 lb., with a 40:1 nozzle area ratio and a chamber pressure of 167 psi."

Combustion was carried out all ranges. Preliminary post-firing examinations

showed little erosion in the chamber throat, Lavigueur said.

Major reason for the low erosion rate was elimination of thermal and chemical hot spots in the injector, which would do damage to insulation. This is an outer ring and sprays the oxidant in pockets from an orifice ring. The droplets are mixed in a vortex, which goes back through the combustion chamber.

The nozzle liner, fuel rod and insulation thermal barrier are creating a cool boundary layer along the walls, Lavigueur said. Unburned elements are evacuated back up the center of the

nozzle until they are thoroughly cooled and burned."

Insulation consists of two principal components, a deep metal dish with an inserted smaller dish at its center. The inner dish has a convex bottom. Fuel is forced into the hollow wells of the outer dish, evacuated around its circumference and spewed out into the nozzle throat through holes in the inside ring.

Produce is drawn into the nozzle dish, where it strikes the convex bottom and spreads out radially into the nozzle throat. The injector is located in the



ABLATIVE LINER (left) of the TD-321 engine is fabricated from prebonded, plastic interlayered cloth. Protective insulation layer, called Alcryn, is pre-coated between it and the insulation shell. Engine developed 3,100 lb. thrust in recent test flights.

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VORTIC ACTION of injectors developed by Thielert Reaction Motor Division is shown in drawing above. Tangential hot injection creates vortex zone which enables it spread rapidly.

In fact, at a fixed-area, constant-throat configuration in a combustible configuration in which men inside the injector is variable, thereby affecting vortex.

Two other thrivable configurations can be developed around the fixed-area injector by using upstream valves in a pulse-flow technique, Longhough said. The TD 121 has a variable-area injector.

Test engine running 550 sec. were run on an other engine, the TD 204, which used the same basic, but much fixed a fixed-area injector, a throtted-in throat liner from the nozzle base and weighed 95 lb.

Minimum combustion pressure achieved in the TD 204 engine was 105 psig at an airspeed flow rate of 11.85 lb/sec and a fuel flow rate of 0.25 lb/sec. Maximum combustion temperature was slightly under 4,000°F.

The TD-204 was designed primarily to prove the capabilities of the basic injector and the basic injector design, Longhough said. "After more than 14 years of being a diameter of the chamber has not changed."

To reduce weight and eliminate spin, an annular portion of the chamber wall is a second generation engine utilizing the new combustion materials and an aluminum shell was developed.

New conditions in the third stage demand a more complex and difficult thermal insulation. It occurs at more temperatures after being passed between the heat and the outer shell.

Stainless steel is lighter than the glass ceramic, ceramics need no metal supporting flanges at each end and can be polished for thermal insensitivity.



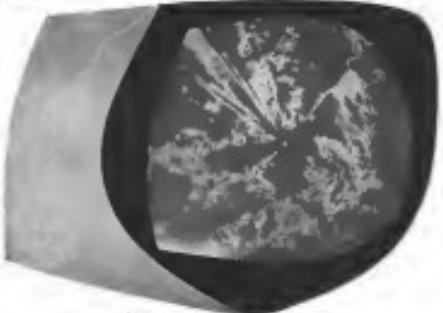
BASIC INJECTOR assembly shows fuel lines at bottom left and upper right leading into outer ring; base is background tool used to assist in assembly.

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TEST BENCH LAYOUT of General Electric's liquid metal thermal system shows electromagnetic pump (left foreground) and single coil loop. Thermocouple wires have been heat-shielded.

GE Develops Liquid Metal System To Stabilize, Control Spacecraft

By Donald E. Fink

New York-Liquid metal systems, which escort nuclei for stability and attitude control of space vehicles by enclosing them through closed loops, have been developed by General Electric Co.

Systems consist of circuits of stainless steel tubing around the pack, van and coil axes. These electro-magnetic pumps do more than merely feed insulation on each coil loop to maintain constant pressure on the circulating fluid.

According to R. E. Thompson, project engineer at GE's General Engineering Laboratory in Schenectady, N. Y., an attitude control system depending on gas expansion would be incapable of fast enough spin tops because of the large fuel supply required. A mechanical system is more practical for prolonged stabilization and passive attitude control, he says.

Stability of the system will hinge on its interaction with the mechanical system, however, to produce large displacement amplitudes when needed or to gear added torque when the mechanical system is accustomed to its maximum capacity.

Thompson said mechanical control devices using generators or servos which also have been developed, but the liquid metal system has fast advantages.

- Liquid metal system has higher inherent stability because it has no moving parts. The system flow is the resultant of crossed electrical and magnetic fields in the electric-magnetic pump.

- Liquid metal system can be scaled

up about 60 times faster than a magnetic coil, thereby conserving scarce resources at their acceptance. It also is more easily regulated.

Systems can take advantage of other uses of space, since the helical loop can follow elliptical paths. The loops also could be integrated into structural members.

Circulating mercury can be used in a heat sink to aid in concentrated heat and from the pump.

Work on the liquid metal system



MERCURY IS CIRCULATED through loops fed by GE engine to exert torque for stabilizing and controlling space vehicles. Control pressure is maintained on the circulating fluid.

is centered here, in part, because it is a company-owned plant and has a lot of GE's work on the attitude-control system for America's Adonis communications satellite. Experiments with new circuit cut using test benches which devices with the liquid metal system involving a second generation development. Even though the Adonis program has run its course in the Adonis control, has been terminated, development work has continued on the liquid metal system.

"Our present task is to develop an attitude control system for maneuvered communications satellites," says Dr. John P. Thompson, manager of the Adonis program. "The principles are applicable to much larger space vehicles," Thompson adds.

In its present state of development the liquid metal system has a better weight-to-torque ratio than other forms of mechanical stabilization systems on satellites in the 1,000-lb class," he said. "Velocities in the class are large enough to allow an efficient known-size length. The weight advantage does not hold true for smaller satellites, but it could be affected with refinements in the circulating system."

One of the circulating systems is the electromagnetic pump, which is reusable. In fact, a magnetic pump is planned to be used throughout the system. Since the current density is limited to 25 amp and 25 to 100 ampere turns, it is possible through the use of right angles to the magnetic field. The resultant force pushes the mercury along the tube. The surface and rate of the mercury flow are governed by the discharge and rate of the current flow.

Refined Device

The electromagnetic pumping is not a new idea, but until recently it was too inefficient for space applications. Thompson said, "Existing air-cooled developments advanced to liquid metal systems designed for nuclear power plants, we refined the pump and increased its efficiency from about 15% to 30%."

Thompson said reliability of the whole system is further enhanced by having the mercury travel inside the loop walls. It would have to be repositioned for the duration of use of the presently contemplated space mission.

The adaptability of the system is almost as great as any satellite is on other important factors," he said. "We found it possible to make sharp changes of direction with the long tubes and controllability therefrom with overbearings without stabilizing the whole system."

Stability of the concept has been proven, he said, with more than 15,000 ft. of testing on components and an integrated three-axis system which matched the geometry requirements of the Adonis orbiter.

Early Use of Scientist-Astronauts Urged

By Werner C. Weismann

Cambridge, Mass.—Institute of suborbital flights and scientific observations in space and interplanetary spaceflights, with goals to go into space, the first metal system is being tested by participants in the National Academy of Sciences' Stevens Study on Space Research, according to Dr. James V. Van Allen.

Van Allen, physics professor at the State University of Iowa and director of its earth radiation belt laboratory, addressed the New England Regional Conference on Science, Technology and Space Held here recently (AVN, Nov. 10, p. 36) under the aegis of the National Academy of Sciences and Space Administration and Massachusetts Institute of Technology.

He recommended the study of the right-hand side, conducted last summer at the State University of Iowa under a grant from NASA. Participants included 75 of the nation's leading scientists and engineers drawn from principally from universities and industry.

Progress of the study can be analyzed in the U.S. space program and solar recommendations are not directions and recommendations given to the researches. Some key recommendations made include:

• **Ground-based studies.** Principal recommendation for astrophysicists, Van Allen said, was that the determination of the lunar surface structure, thermal and subsurface properties of the crust, seismology, temperature of the crust as a function of depth, diurnal variation of the crust and topography. Robert pants in this study group took a strong stand on the importance of seismometers installed on the moon's surface and in deep shafts.

• **Orbiters.** Members of this study group developed the concept of low-orbit solar observatory. Terrestrial observatories, which would be located at a planet at the time a probe was passing, information on the surface and atmosphere of the planet would be obtained by transmission.

These scientific objectives would set up cognitive for the pilot astronauts, but their greatest function would be on the open-space communications and measurements of phenomena that might go unnoticed by a conventional, fixed-position sensor.

• **Orbits.** One orbit from 10 to 20,000 km, including heliocentric, planetary and solar systems, as well as geosynchronous.

Van Allen said he knew of several commercial scientists who have expressed willingness to begin training at an early stage.

Other groups and three recommendations were included:

• **Biology.** Group number agreed that

biological life, most of the prime objectives of space exploration. However, looking in greater detail, they the possible colonization of other planets, particularly Mars. In spacefaring nations and are urging strongly that Mars be kept as "colonial ground," until a thorough investigation has been made.

The continuation of the various col-

lating the signals, which the probe would send directly from the earth-based radio with the echo base via phonetic-NASA-University relationships. So orbits at the start entailed the "initial environment" in which they were forced to provide their work, if they worked to have gained space on a NASA satellite, including the capsule were less orbital of plus two years in advance of the launch date. They feel that this is wholly unnecessary, Van Allen said, since their project could become available during that period of time in the early development of the probe that should be available in the experiment.

As a solution to the problem, our former recommended that a policy of block allocation of payload space be established, in which qualified scientists would be allotted a certain instrument weight and power, with no restriction on the nature of the experiment. This would substantially shorten the period between conception of the experiment to the execution. Van Allen said, and based the choice of spaceplane. Group 10 endorsed a Navy plan to give an auxiliary satellite a while visibility to use it as a test bed. Such auxiliary satellites would probably be selected by means of a competition, where several satellites share a satellite.

• **Mathematics.** Participants in this study group recommended increasing the number of sounding rockets and balloons, which would facilitate a more accurate measurement of the earth's atmosphere than a satellite.

• **Aeronomics.** Members of this study group developed the concept of low-orbit solar observatory. Terrestrial observatories, which would be located at a planet at the time a probe was passing. Information on the surface and atmosphere of the planet would be obtained by transmission.

• **Atmospheric Physics.** Group members emphasized the need for more research on the chemical, molecular and wave properties of the earth's atmosphere above 50 km, with specific attention to be paid to such phenomena as ion glow and aurora. They cautioned against the use of sounding rockets, particularly in satellites, which could be performed as well as better by conventional satellites, such as the Posture observatory, themselves a huge dipole field itself, that is mapping the earth's atmosphere and magnetosphere out to earth orbit.

In another session, the conference issued a report of international scientific cooperation with the scientists of other Western nations and with Soviet scientists, whenever possible.

Proceedings of the interim study, which was closed to the public, will be published by the National Academy of Sciences later this year. Many of the recommendations have been studied by NASA and incorporated into its programs, Van Allen said.



Space Recorder

Lockheed Corp. is developing tape recorders monitoring the MIR-7000 shown above, for flight resistance to vibration due to space vehicle passage of Lockheed Missiles and Space Co. The tape code of more than 1,000 ft. per hour weighs 1.8 oz. Cost of the entire assembly is approximately \$10,000. MIR-7000 records up to 170 rpm at 1.8 ips. It is a self-contained, hermetically sealed unit with speaker and microphone tape.

FINANCIAL

SEC Lifts Stock Trading Ban After Atlantic Research Amends Reports

Trading in the stock of the Atlantic Research Corp. has resumed on the American Stock Exchange after a five-week suspension ordered by the Securities and Exchange Commission, that excused from a registration statement filed by the company for a secondary offering of 179,000 shares of Atlantic stock.

Company has entered into a stipulation with the SEC consenting to issuance of a stop order against the registration statement and agreeing to the issuance of the SEC's advisement in which the adequacy of the registration statement was challenged.

Company Solvency

Atlantic's board of directors reported to stockholders that the solvency of the company was not questioned. The SEC action was based principally on lack of disclosure of \$1,861,722 in loans authorized by Dr. Arthur W. Sloan, Atlantic's president, to Texas Capitol Investments, Inc., and used to purchase Atlantic's stock in the open market and \$550,917 to Pan Ridge Corp., and for other corporate purposes.

Texas Capitol, owned by W. O.

Bowers III, of Austin, Tex., a personal friend of Dr. Sloan, was engaged in 1958 in saleable to him and Franklin owned by Pan Ridge at Gainesville, Va., and for buying by Atlantic, the SEC said. Pan Ridge was organized in 1955 to acquire this land, and its stock originally was held by Dr. Sloan, Dr. Arthur W. Sloan, Dr. George Schwartz, and other Atlantic employees. Pan Ridge later sold facilities to Atlantic at the site.

Besides the stock purchases, the SEC said, both companies served as conduit for other loans from Atlantic to individuals or in connection with Atlantic's purchase of interests in other companies.

SEC also said that Atlantic's annual reports for 1968 and 1961, reporting net income of \$311,859 and \$2,471,192 respectively, did not reflect losses of subsidiaries. Consolidated results of both entity share deficit.

Atlantic's board, following an investigation that confirmed the loans—which it said were made without authority from the board—had voted to add two new, outside directors to the board and appointed an executive committee. In-

cluding board powers with Dr. Sloan as chairman.

Based on law with SEC suggestion, ended changes in the company's accounting methods, and it also ordered admissions of updating:

- Establishment of a reserve of \$1.5 million-\$200,000 net after management possible loss on notes receivable by Atlantic, including those of Pan Ridge and Texas Capitol. Loss reserve, then, were reported by Atlantic as totalling \$1,518,510 as of June 30.

- Additional general guarantees were provided by Dr. Sloan and Dr. George Schwartz who own approximately 46% of Atlantic's stock, and the two a third of trust the 183 acres leased to Atlantic (now Texas Capitol) at Gainesville, adding amount estimated at \$764,000.

Stock Value

Consistent of Dr. Sloan and Dr. Schwartz are dependent in some extent on Atlantic's stock value. At the date of suspension, Oct. 10, the stock was selling for \$12.50 a share, though Pan Ridge had paid as high as \$15 a share since 1961. On reopening, on a block of 5,000 shares, the price was \$13.50 a share. Dr. Sloan, as of July 31, had pledged his \$12,000 shares of stock and other securities in collateral with banks and brokers for loans of about \$6.5 million.

- Provision of \$850,000 in its inventory valuation, against the revalued balance of its subsidiaries as reported to meet the completion of government contracts.

- Written off \$811,932, the excess of the cost to Atlantic of acquiring the General Communication Co. over its present net fair value.

- Effect of these and other accounting changes and adjustments:

- For 1961, Atlantic showed a loss of \$1,471,192 instead of \$2,471,192.

- For 1963, Atlantic showed a \$1,471,192,000 loss instead of \$1,471,192 profit.

- For the first half of 1962, a loss of \$47,707 instead of a profit of \$1,471,192.

Dr. Schwarz issued a personal statement in which he said that the losses cited were made within his authority as chief finance officer of Atlantic Research, and that he had no personal interest in either Pan Ridge or Texas Capitol Investments. Both are independent of Atlantic Research, he indicated, and the performance of Atlantic stock by those were bad because their managers believed the stock of Atlantic to be an asset of great potential.

He said he concurred in the steps taken by the board, and added he did not believe the long progress would result in damage to Atlantic stockholders.



This airplane detects, early warns, controls intercepts, and has a heart.



This is the heart.

The airplane belongs to the U.S. Navy. It is a Grumman WRF-1 Hawkeye. It is one of the fastest carrier-based aircraft, is maneuvered by a crew of five and was designed to perform airborne early warning missions. Technically, for long range radar detection and control of intercepts with maximum reaction time.

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Red Bank Division



Air Force Accepts Texas Tower CH-3Bs

Air Force has taken delivery of three additional Sikorsky CH-3B helicopters for use in support needs for Texas Tower and various locations of the New England coast. These CH-3Bs shown above will be stationed at Otis AFB, Mass. Three olderish 25-passenger CH-3Bs, (S-61) have been used at the tower since since last fall spring (AW May 7, p. 60).

Skybolt Hydraulics Function Successfully

Draint-Hydraulic control system for the Douglas Skybolt air-to-surface ballistic missile has functioned successfully in the last ten flights conducted to date, according to company officials.

Details of the Skybolt hot-gas-powered hydraulic control system and the Control coated system were reported recently at the Volken Aerospace Thread Power Conference here.

Skybolt uses solid-propellant hot gas generators designed by Douglas to drive hydraulic motorpump packages supplying control power for both stage.

Motorpump packages designed by Volken Aero Products Division are standard multi-piston, fixed volume pump and motor units mounted back-to-back and driven by a common shaft. Like gas at 2,000°F, they produce driving fluid pressures up to 10,000 psi to the motorpump units, plus power to the motorpump pump unit to other subsystems, including the control servos. Gas pressure is maintained at 2,000 psi by a relief valve which turns even pressure emboldened, thereby providing a constant torque input to the motorpump wheels (rate speed) to meet hydraulic system demands.

Hot-Gas Accumulator. The hot gas accumulator, consisting of the gas produced from igniting the hydraulic side of the system during pre-flight, stored pressurized.

Walt Kline, Skybolt manager engineer, Volken Aero Products Division, described the first stage motorpump package as "standard 10-dg. hot gas pump driven by a 10-dg. motor through a reduction gearbox at 2,000 rpm, with a maximum flow of 7,500 gpm, with a maximum flow of 12 gpm. Unit weight 5.8 lbs."

Second stage unit is also a standard 10-dg. pump driven by a 10-dg. motor through a common shaft. Package is rated at 5.6 in hydraulic horsepower at 7,000 rpm. System pressure is a maximum of 5,000 psi, with a maximum flow of 3 gpm. Unit weight 5.8 lbs.

For combat effects, heat and fire must be kept extremely well throughout aerospace construction. Copper impregnated cable is used for wire lead and exhaust tubes which are returned by a pipe mechanism which provides the required vent area to reduce gas pressure. Temperature at the inlet valve exceed 1,900°F.

Motor cylinder block is sealed, cast iron venturi used. The main motor power is of disc-latching design as opposed to the传统 potentiometer as a non-contact hydraulic valve.

Present and future work are through-housings and valves for thermal hydraulics and solid-state. Motor cylinder block connected to the common shaft through a set of lead gears. Motor is driven from the power assembly by a carbon-fiber bellows-type shaft used to minimize use of deleterious seals.

Standard internal link drive the conventional pump ratings available. Thrust loads are balanced between pump and motor except for efficiency losses. Reaction forces is absorbed by the bearing stack on the shaft.

During operation, a slight loss of lubricating oil and cooling oil is introduced into the system which is caused through the gas exhaust system. Cooling of the system is provided by heat sink stage at 11.5 lb./sq.in.

Volken says this has reduced a substantially lower amount of oil needed.

Motorpump testing is accomplished with pressurized ambient temperature nitrogen gas as a static firing of a propellant charge.

Volken was compelled to the need to keep the ratios within accepted state-of-the-art temperature limits because

Norstad Reviews NATO's Military Posture

New York-European medium-range ballistic missile force to replace North Atlantic Treaty Organization's shorter range missile force still is being discussed, but no responsibility for its establishment have been made, Gen. Louis Norstad, NATO commander, recently reported.

Norstad told NORAD members in an annual force to kill off five years ago, however, the missile should be using its effectiveness against certain targets in the initial deployment.

The modernization covers the implementation of missiles which because of Europe's position inherently become MIRVs, he said. Control of the nuclear weapons delivery systems is one problem, but it should not be limited strictly to the missiles.

Norstad made the comments in an interview broadcast Nov. 11 on "The Team Work Column," a Columbia Broadcasting System documentary series. Asked why his 1977 recommendation to develop a second generation NATO missile to replace the obsolescent Thor have lagged down, Norstad said they have not, because NATO now has the Polaris submarine and the U.S. will update Thor missile.

Norstad also noted these plans on NORAD's desk in Europe.

8 Legato plans have been developed by the nations to cover their participation in rapid force increases from the U.S. to Europe. Some plans are only 25% of the required 50,000 personnel in Europe; a program was worked out within the last year to deploy some 10,000 troops. Equipment is stored in Europe and the men are free to "just like our own personnel," with about 40 lbs. of luggage. This capability, using Military Air Transport aircraft, was demonstrated last spring with Operation Long Thrust (AW Nov. 14, p. 87).

* NATO troops are now committed to meeting an enemy attack at the front. Certain and holding that line for a longer time. This new concept, under which the main forces will be brought forward down a supply line to join the retreating forces in case of attack, was implemented this summer.

* Conventional actions in Europe will not intentionally prompt nuclear war. Use of nuclear weapons will depend not only on what is happening, but the context in which it is happening. NATO's conventional forces have coined the "threshold" the level of transgression of which nuclear weapons will be used, to a high point.

and a good sealing material for mounting points. Aluminum plates and body enclosures part at all of the power and components.

One power unit is provided for each engine assembly in the standard configuration, which will make a clearly hot section with a minimum surface exposure to low ambient temperatures. Engine positioning, activation of conventional fixed-type attached in engine and engine sleeves.

System components include a semi-axial, cantilever type, fixed displacement hydraulic pump capable of 1.5 gpm output at 12,000 psi. The pump is connected to the engine by a flexible nylon coupling to limit heat transfer between pump and engine. The pump is embedded in the power package to keep it warm.

A 1.84 cu. in. volume accumulator was planned to sharpen weight and cut pressure fluctuations, resulting in lower fuel rate. This can be best illustrated visually as the power package, because as the position of tank in percent reduces the volume of the gas charge which would expand by decompression.

Booster is a saturated fluid reservoir, to prevent cavitation in the main pump, is the largest component in the power package and forms the mass body of the unit. A high-pressure relief valve limits outlet pressure to a nominal 3,700 psi, providing a constant torque load for the power unit.

Low pressure receiver thermal relief valve prevents thermal overpressurization in the low pressure side of the totally enclosed system.

Studies indicated that the power package forced to extend three times its normal dimensions when the Clinton's aerospace system was shut down, Deven said. That form has since been found to be sufficient to keep the system operating during most phases of the flight if the main hydrazine fluid could be supplied to the system's earliest points.

Accordingly, a sterilizing cartridge type pump, driven by a 25 v., 5,000 rpm d.c. thermoelectric activated electric motor, was provided to stimulate fluid when the coldest points of the system reached a preset temperature.

Actuation unit, installed from the cold engine and actuator attachment clevis, through use of plastic blocks and cables, to the valve to the pressure transmitter. Upstream from the valve is a series of a square duct around the cyl. units in which fluid flows in directed during main and sterilizing valve operation to warm the whole assembly.

A 16 cu. in. stainless steel shell with mesh element filters all fluid entering the actuator prior to delivery to the serve valve. The arrangement places the filter as close as possible to the valve to prevent introduction of contamination from intermediate sources.



Titan 3 Model Tested

Scale model of the Titan 3 upper booster module had been checked by a technique prior to tests in the dynamic test stand built at Cornell Aeronautical Laboratory, Buffalo, N.Y. The experiments were conducted by Cornell for the Martin Co. These prove concepts. Pressures and aerodynamic forces and moments were studied at high Reynolds numbers and low speeds simulating ground conditions.

3 PROBLEMS

1. Light weight, frequency stable elliptic 10 watt 3 Band confocal for telemetry. Must operate at low voltage, be extremely frequency stable, precise, simple and reliable, meet gas and moisture test, stay below magnetic interference, and meet usual special missile environment specifications.

2. Amplifier at least 10 watts output over active band with 40 to 50 dB saturation gain. Must not require separate power for biasing nor forced air or liquid cooling. Size and weight must be minimum to meet typical missile sensor module specifications.

3. 15 watt oscillator voltage tunable over 12% bandwidth in L-Band. Linear frequency/ anode voltage characteristics required. Minimum frequency drift with temperature. Must be self contained, only electrical connection to subcontractor. Minimum size and weight to meet typical missile environment specifications.

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Environmental: Meets typical
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X1021
Truncating Wave Tube
Power Output: 10 watts min.
Frequency Range: 4.8 to 8.0 Gc.
Saturation Gain: 40 dB.
Focusing: Resistive.
Cooling: Heat sink.
Size: 13 x 13 x 1.85 inches.
Weight: 25 pounds.
Environmental: Meets typical
missile specifications.

X1086 Voltage
Tunable Magnetron
Power Output: 15 watts min.
Power Output Variation: 15%.
Freq. & Bandwidth: 12% in L-Band.
Frequency/Anode Voltage: Linear.
Temperature Compensation:
±0.005% of operating voltage/°C.
Electrical Characteristics: Resistive
anode, injection voltage only.
Output: Circular.
Packaging: Permanent magnet.
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Environmental: Meets typical
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Peruvian Navy Receives Bell 47G-2As

Peruvian Navy has received two Bell 47G-2A helicopters for use as miners, rescue and anti-sub sabots. The aircraft were delivered to Lima, Peru, late in October from the Bell factory near Fort Worth, Tex. One of the helicopters had flotation gear, the other, shown above, was equipped with standard skid landing gear.

F-101 Target Prices Excessive, GAO Says

Washington—General Accounting Office has charged in a report to Congress that Tracer Aircraft Corp., now a part of Learjet-Aircraft-Vought, Inc., will receive \$1.2 million "for unearned profits" when it receives target prices on F-101 subcontractors are reduced.

GAO said that the "unearned profits" to McDonnell Aircraft Corp., the prime contractor, stemming from the alleged overcharges on the subcontractors, would amount to \$139,300.

The contracts were incentive type under which the contractor is rewarded for reductions in target prices through performance. GAO noted that Tracer exceeded the amounts of its costs.

The report said that costs to the government for the target price items for F-101 aircraft will be increased by about \$1.5 million because estimated costs included in the target prices for the subcontractors and prime contractors were excessive of the time the targets were negotiated. Comptroller General Joseph Campbell said in a letter of transmittal:

"The error is being reversed by Justice Dept. in civil actions."

"In negotiating new target prices on subcontractors for F-101 airframe assemblies," the GAO report said, "Tensco proposed and McDonnell accepted prices which were based on cost estimates that were excessive. The approach also failed to take into account the reasonable profile to Tracer in that the subcontract target prices were established subsequent to the subcontract negotiations. Tracer certified that

it had used current, complete, and correct cost and pricing information in its target cost proposals and that such information as was available to Tracer had been furnished to the McDonnell by prior to the conclusion of target negotiations."

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USAF Project Seeks Inventory Control

By Ward Wright



Sud Aviation of France is flying an Alouette II prototype powered by paired Turbomeca Bastan turbine engines developing 990 hp each. Turbomeca is offering the twin Bastan power installation as a retrofit program for the H-34.

Sud Installs Turbomeca Bastan Engines on H-34



Empty weight of the helicopter is 1,609 lb and gross weight is 11,286 lb. Sud's two Bastan HF30 first flew in early October. Company assembled 82 Alouettes for the French government, then built 135 under license, including five for Belgium.

Wright-Patterson AFB, Ohio—Project MINT, as it's known, Air Force Logistics Command effort to reduce a Lockheed Cessna inventory growing to 300-400 items monthly, has entered its initial phase with a comprehensive survey of federal stock and manufacturing parts needed to wind up duplicate items.

Logistics Command created MINT (Mobile Inventory and Net Base Control Techniques) last May after a three-year period of concern over growth rate of the USAF inventory and steadily higher cost of its service.

An Army inventory increased by 121,000 items, or 28.4%, between January, 1959, and July, 1961. During the same period, Army's inventory gained 116,000 items and the Navy's only 3,000. At the USAF site, Logistics Command estimates it would have to manage 2.7 million items by 1965 and 3.3 million by 1970.

Program Background

Warnings that Logistics Command would lose its inventory management base have existed for some time at USAF Headquarters. General reports, General Accounting Office review, pre-bid to Defense Dept.'s Project Whirlwind to cut all military inventories, and Logistics Command's own inventory reduction task programs.

These warnings led Logistics Command to begin inventory reduction programs in late November 1961 and again last January, while the MINT concept was being developed.

First program was an order to Air Materiel Area commands to begin survey and eliminate 10,000 components of Logistics Command's most troublesome inventory items. This would not be practical until the item's characteristics had been sorted against those already in the inventory. This policy, expanded with additional parts and applied to all federal supply items, grows, is essentially the foundation of MINT.

Second program was an order to Air Materiel Area commanders to begin eliminating items no longer needed with a Calendar 1962 goal of a 100,000-item reduction.

Another factor in MINT's origins is the demand made in the inventory management rules for the rapid liquidation of a mind, no gear worn down towards and development to production

stage. The Boeing B-52 jet bomber, a Logistics Command spokesman said, had a five-year design stability plan. During that period there was time to develop a parts list, merge federal stock, standardize and build an inventory.

With savings, R&D is followed quickly by production, working a three-stage, no-wastage problem sequence of these milestones are to begin major report and at the same time the inventory is better manageable.

Under the MINT timetable which begins last May, with a letter from Logistics Command Vice Commander Lt. Gen. Kenneth B. Hobson, L-306 headquarters and other personnel in the area regional Air Materiel Areas were briefed from their duties for one year beginning last Sept. 1 in implementation MINT in two phases.

Phase one is an educational campaign of indoctrination, part numbers against federal stock numbers to determine if duplicate articles by a manufacturer part can be identified and removed from federal stock, whether or not the parting excess. Duplicate items will be cross-referenced on elimination.

During this phase, MINT personnel are collecting identification numbers, part data, blueprints, drawings and quick feature sheets for all items in the inventory for use in phase two.

Key to the MINT program will be the use of manufacturers' engineering

data to form what Logistics Command calls a "characteristic data base." The data base will consist of a uniform, ordered designation of all significant physical and performance characteristics of a given item. These data bases will form the nucleus of Logistics Command's new item control techniques as an alternative to current accounting and storage.

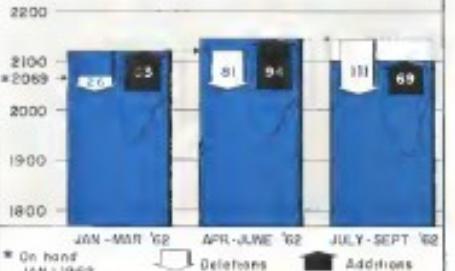
For accuracy, time, Logistics Command's high volume procurement areas, data bases will be used for machine processing. Based on these areas, according to MINT Project Manager Philip C. Urschel, are largely due to the commercial economy and have the greatest potential for standardization and consolidation.

In fiscal 1962, two of these high volume groups accounted for 56.5% of the total inventory increase, with seven auto, federal supply groups totaling 9.9% of the increase.

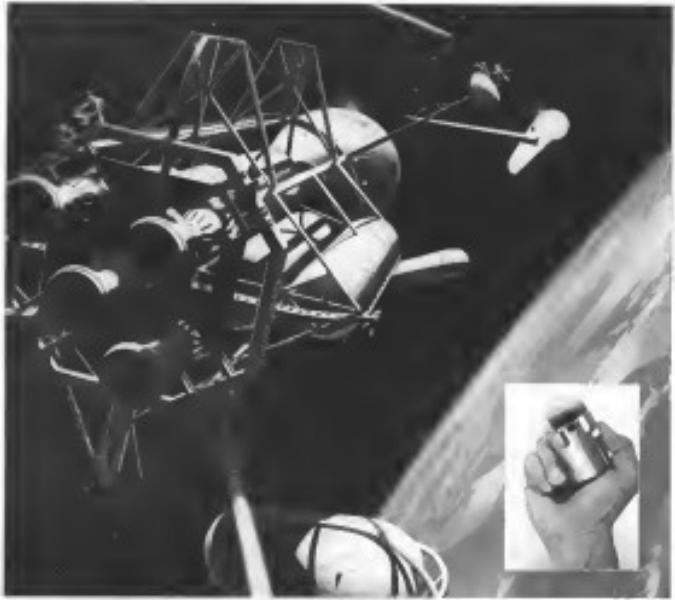
The main phase annual savings of government does not warrant a precise projection, but it is likely to fall just on a trend of recent reduced rates in general already familiar with the stock's growth characteristics.

Once these data bases have been developed, reanalysis scanned for stock number depletions and pending items will be grouped by physical and performance characteristics to determine if further depletions or any interchangeability relationships exist.

Deplete items will again be con-



TOTAL FEDERAL stock numbers in USAF inventory (left) dropped for the first time during the third quarter due to inventory reduction programs. Historically, depletions (downward arrow) were always offset by inventory addition (upward arrow).



Project Cap Pistol

"Cap Pistol", a solid-state rocket motor, is as simple as its name sake in concept—and even easier to site. Developed for the US Air Force by the Wright Aeronautical Division of Curtiss-Wright, it is a space vehicle control system designed to guide spacecraft precisely on course during flights outside the earth's atmosphere.

Cap Pistol fires lots of solid propellant, each an individual rocket motor, to make possible controlled pitch, yaw, and roll in outer space—where the mere force of a whisper can maneuver a multi-ton spacecraft.

A new concept in rocket propulsion systems, Cap Pistol is by far the most reliable yet devised for a variety of space applications. Cap Pistol can control anywhere in a space vehicle without regard to pressurization or fire lapses—and offers a sure-fire ignition capability for deep, smooth, precise.

Cap Pistol is one of a series of advanced rocket engine projects being conducted by the Wright Aeronautical Division today. For the spacecraft of tomorrow. Information is available on request.

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widened or eliminated at this stage. Interchangeability and substitution tables will be published by Legatee Company.

While Legatee Company has been responsible for development and publication of interchangeability selection charts in the past, demands on personnel have kept the command from fully employing this function.

Other activities have been reduced through an early concern of physical and performance characteristics, several via interchangeability and substitution which may be expected to result.

After the MINT program, data banks will be used in hopes of compression to reduce all new procurement effort to determine whether the invention already has an article that will do the job or whether an interchangeability possibility exists that would make procurement unnecessary.

If a new item must be purchased, it will be described in a data sheet and be used as a standard for procurement in future purchases. Data book for an interchangeability chart will be kept at the Air Materiel Area responsible for supply of that item.

Procurement Guide

Another facet of MINT will be the issuance of criteria to guide Air Force and industry in procurement. Many factors to be stressed here is the need for detailed items other than cut-and-dried products.

Classified contains a series of three rated checkbooks developed to provide areas which would interest procurement personnel according to procurement needs of the Air Force. These books would describe what selection of standard items are available, their characteristics, and suitability in what ability to Air Force needs. Similar checkbooks would be prepared for an item, too, to emphasize Air Force's need for standard items.

For instance, a handbook on electronic nose would stress the possibility of having plain wire in the coil in standard coils codes as opposed to anti-knots sections with maximized coding, even requiring a separate legend for the latter.

An Air Force would want the size to length as needed and code, if necessary.

During phase two, the initial trials of collecting interchangeability data on data bank would be undertaken followed by reviewing to eliminate further inventory difficulties.

Also, any interchangeabilities as established or substantiated discussed in the present will be published.

During this phase, the groundwork will be laid for publication of criteria handbook.

By the end of the project, scheduled



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SPACE SYSTEMS ANALYST—PhD in engineering, physics or mathematics are needed for work on advanced materials and nonlinear space problems.

SENIOR ENGINEER—B.S. or M.S. and PhD in EE and Physics who have experience in one or more of the following:

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AERODYNAMICS ENGINEERS—B.S., M.S. or PhD to conduct theoretical and applied studies in the area of supersonic and hypersonic compressible, wings, and gas flows. This work is directed toward the complete appraisal of the aerodynamics of re-entry at orbital and space vehicles.

test equipment supporting the programs include computer electronics, mechanics and laboratories, a hypodermic research facility, an ultrahigh-pressure physics laboratory, both special and general purpose computer facilities.

General Dynamics/Fort Worth offers a hospitable locale with a cold, even climate and abundant recreational-educational facilities, in a community of 400,000 population. For additional information concerning the above openings write Dept. J-8, General Dynamics/Fort Worth, P.O. Box 7466, Fort Worth, Texas. An equal opportunity employer.

Aug. 30, 1963. Hanford hopes MINT will have accomplished five objectives: validation of stock utilization management at the three development and fabrication laboratories; establishment of data bases for new flow control, and publication of Air Force design documents pertaining to future handbooks. After a transition phase planned to be completed by January 1, 1964, the validation function will be turned over to MINT will be turned over to a 710-man personnel staff at the Air Materiel Area and Logistics Command headquarters. The staff will keep data bases current, system data, cause prevent data bases, continue to publish withdrawable publications, maintain standards at the lower apparent and keep critical handbook current.

Much of the material MINT is using to attain its goals has already been available to Logistics Command. Regular inventory procedures have provided for continuous monitoring and elimination of duplicate items.

However, the volume of new items flowing into the inventory, coupled with a desire in Logistics Command personnel, has led to practices where it became easier and quicker to assign them a new federal stock number than to perform a thorough analysis, check to determine if the item was already in stock.

So far results for Air Force's analysis

has radiation programs have been encouraging. During the third quarter of 1962, the embarking of proven in-service nuclear programs and more fully from MINT procedures has lowered the Air Force inventory from a high of 214 million items at the end of the second quarter of 1962 to 209 million items at the end of the third quarter.

Procurement Savings

Savings expected from MINT are not known, but a beginning 30% reduction in federal stock numbers would lead to a substantial savings in practice work and executive management costs, Gen. Mark E. Bradley, Jr., commander of Logistics Command, said.

Examples of inventory problems MINT is trying to eliminate were highlighted in a 10-month preliminary study of small fuel system improvements in September 1962, in connection with Defense Dept. Project Reliability. For example, the study found that nearly half 946 "different" items of fuel supply hardware, each with its own federal stock number, and is present in separate item. After MINT program plan started last with one listed stock number would be present. Terminal working would be done in DMSA. Work would be checked in data base for nuclear responses with timely proposed procurement item to determine whether new procurement is needed.



EXAMPLE of an item where MINT can reduce federal stock numbers. Contracts for identical except for some minor stretching between tanks. Under present classification, each tank has its own federal stock number and is present in separate item. After MINT program plan started last with one listed stock number would be present. Terminal working would be done in DMSA. Work would be checked in data base for nuclear responses with timely proposed procurement item to determine whether new procurement is needed.



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GENERAL DYNAMICS | FORT WORTH

Fairchild Seeks Larger Space Business Role

By Edward H. Koloski

Hagerstown, Md.—Fairchild Systems Corp., which had a net loss of \$17.8 million in 1978 and about \$6 million in 1980, is moving into its own as a stand-alone aerospace contractor with ambitions for space, missile, and space probe contracts.

The corporation showed a profit of \$1 million last year on the basis of its decision to accept a role as a systems-level organization to which prime contractors and their principal second tier contractors come for components and subsystems. Fairchild Systems continues to produce and sell one F-27 aircraft each year and looks to the aerospace field as the next major growth potential source.

Lou Faudon, corporate director of advanced engineering who joined Fairchild a year ago from General Electric, oversees the new emphasis. Approach aimed at establishing within the company a complete systems awareness in the space market.

To generate this awareness and at the same time provide proof of Fairchild's increasing capability, the corporation last fall was assigned Fairchild's going and gone if it's chosen to maintain a broad knowledge of space development so that company management can "decide cost early." Help from NASA will enable Fairchild to provide direct engineering assistance to the company's first division.

Expected Growth

Fairchild's group, headed by President L. J. P. (Pete) Breslin, has 130 employees that the staff will grow to 200 during the next year. Scientists and engineers on the staff are developing ministerial programs which this summer will be submitted to National Aeronautics and Space Administration and the Defense Dept.

As it expands, the group will target programs designed for complete space craft vehicles.

Capacities in house exist for such programs as fixed-wing aircraft, for such programs which have been referred to NASA. That is:

- Steam sounding rocket which failed in fundamental concept from only one successful attempt. In project, launch vehicles with solid Rocket E. Hughes, working manager for the space systems group and various rocket able to lift 12 lb. payload to 110,000 ft.
- Apache solid rocket which has been developed from only one successful attempt. In project, launch vehicles with solid Rocket E. Hughes, working manager for the space systems group and various rocket able to lift 12 lb. payload to 110,000 ft.
- Unmanned lunar rovers, weighing about 45 lb. and consisting of just part of the Surveyor soft landing landing payload. Landau plans to build a crash model of the latter-powered vehicle, which

is to be used for early design studies.

The other concept is a low weight solar sail. Part of the low weight concept is to show an alternative procedure to reduced specific impulse drops to about 60 sec, which is not acceptable to some needs of the low weight.

Fairchild proposes a 100 m long film sail which can be made with

water and atmospheric sounding wave loads.

Satellite has been demonstrated to the

Westinghouse Air Force and Army,

and has been proposed to NASA for development.

Willard Powers of Fairchild has a patent on a system for the nuclei which weighs 115.5 lb. in its liquid configuration. Water weight is 23 lb. in inert parts. All is propellant, 33.3 lb. total payload, 12.5

kg. weight.

Water, cut rates and propellant freezing are controlled so that constant loading rate and chamber pressure is maintained. This results in a constant level of thrust. The rate associated with the minimum thrust has a burning time of approximately 6.5 sec.

To date, the company has not resulted in significant performance in its first developmental attempts. In other programs, Clev is a straight stage rocket which is loaded with supercooled steam and when a nozzle section is removed, steam simply takes off. Because of the low density of steam, mass after retrieval



STEAM ROCKET is undergoing a test firing at the Fairchild Boston test rig at Hagerstown, Md. Concepts and a steam rocket able to carry 12 lb. payload to 30 mi. are to be marketed by low cost 1000 ft. of steam rockets are bought in quantity.

in the concept have been lost.

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Of interest to engineers and scientists

$$[I - \Delta_f(\theta_{\phi A} + \theta_{e,b})] A = \text{critical buckling load}$$
$$(\Delta_f \phi + \Delta_e e) + (\Delta_e \phi + \Delta_f e_c) e_c$$

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To date, the company has not resulted in significant performance in its first developmental attempts. In other programs, Clev is a straight stage rocket which is loaded with supercooled steam and when a nozzle section is removed, steam simply takes off. Because of the low density of steam, mass after retrieval

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WHO'S WHERE

(Continued from page 21)

Changes

John H. Mansfield, head, Air Defense Systems Design and Test Department of The West Corp., Bellwood, Ill., and Alan J. Mihalek, head, North Command Systems Division.

Frank N. Corbin, manager of the newly-established Cellular Interconnection Laboratories, Los Angeles, Calif., a West Coast division of Hughes Tool Works Corp., a Division of Hughes Electronics Corp., May 1.

Joseph C. Ross, a manager of operations Pacific Intercommunications, Inc., Los Angeles, Calif., a subsidiary of Thompson Ramo Wooldridge, Inc. Also Roy A. Brooks, manager, PSL Divs. and Radiotac Divs., Long Beach, Calif., promoted PSL Vice President.

Donald F. Makinson, Boeing Co., Wash., resigns. D. C. represents responsible for defense missile and space activities.

D. David A. Eales, chief engineer, Mr. Space Division, Hughes, Inc., a subsidiary of Hughes Electronics Corp., Los Angeles, Calif.

Devin F. Avery, general manager, Houston Product Corp.'s Nuclear Research Division, Cypress, Texas.

Paul L. Shugart, assigned to the sheet aluminum division of the Metal Products Corp., Inc., Los Angeles, Calif., goes to the U.S. Steel Corp. as vice president of engineering.

Albert C. Lowe, management assistant, Hughes Space and Communications Division, Culver City, Calif.

Lt. Col. Edward D. Lunde (USA) ret.), pasted director of the newly established Government Programs Service, Inc., Englewood, N.J.

Robert L. Sander, marketing manager, Hughes Space and Communications Division, Culver City, Calif.

John E. Woodard, corporate director of national Test Laboratories, Inc., Dallas, Tex.

Dr. Michael F. Witt, director of research and analysis, McDonnell Corp.'s San Francisco, Calif., Federal Division.

Albert F. Wild, manager, Southwest region operations for General Electric Co.'s Defense Systems Operations with headquarters in Houston, Texas.

R. L. Hildreth, director of electronic systems, Western Division, Northrop Corp., Van Nuys, Calif.

Dr. Robert S. Corbin, director of company's Solid State Division, a Division of Hughes Electronics Corp., Culver City, Calif., and Edward J. Maciasik, manager director, James C. Flanigan, director of Space and Electronics, Charles H. Sebold, manager, Control Identification Division.

James W. Borkin, director of the Hughes Electronics Division, Culver City, division of Hughes Electronics, Inc., Los Angeles, Calif.

Zelma Barnes, supporting program manager, space and missile, Lockheed Propulsion Division of Pacific Division, Corp., Culver City, Calif.

Col. M. R. Cutler Jr. (USA) ret.), manager of the newly created product support program office, Space Systems Division, Lockheed Missiles & Space Co., Sunnyvale, Calif.

William H. Gothic, director of organic materials, Avco Everett Research, Inc., Everett, Mass.

Carl E. Hall, contract administrator for the ER-211 program, Michael L. Johnson, Inc., a member of the Gemini Corp. team, assigned to the Hughes Electronics Corp., Culver City, Calif., a division of Hughes Electronics, Culver City, Calif.

Brian Franklin, director of marketing, Infrared Laser Corp., Chatsworth, Calif.

John Vengroff, director of engineering, Defense Systems Division, a Division of Hughes Electronics Corp., Culver City, Calif.

Steve A. White, William A. Baker, Jr. (USA) ret.), manager of Washington Electric Corp.'s newly established corporate business Planning and Marketing Staff, with offices in Washington, D. C. Steve is manager of Mr. Col. K. E. Cowles (USA) ret.), Col. John C. Cowles (USA) ret.), Col. Edward L. White (USA) ret.).

Transport Division of Boeing, Inc., Riverside, Calif.

M. L. John, managing director, Syntex Corporation, Co. Ltd., London, England.

John A. Schmitz, director of several projects, Defense Systems Corp., South Pasadena, Calif.

William N. Mansfield, manager for the air arm division, Inc., at Dulles International Airport, Va.

Edgar H. Webb has joined the staff of MHD Research, Inc., Newport Beach, Calif.

Robert W. Dagen, marketing director, Amplex, Inc., Mountain View, Calif.

Arnold L. Kaplan, manager, Technical Sales, The Boeing Co.'s Transport Division, Seattle, Wash.

Mark W. DeWitt, Dir. of the Hughes Division's Project Office, Geneva International.

James Redden, senior staff scientist of the Hughes Laboratories for Electronics, Long Beach, Calif.

Gen. Charles E. Faison (USA) ret.), liaison to the Research Analysis Corp., Culver City, Calif.

W. M. Brinkley, assistant general manager, Douglas Aircraft Co.'s Torrance Division, Calif.

Col. Jack E. Bradley (USA) ret.), was appointed corporate planning manager, General Electric Co.'s Light Military Electronics Department, Utica, N.Y.

Albert C. Lowe, management assistant, Hughes Space and Communications Division, Culver City, Calif.

Lt. Col. Edward D. Lunde (USA) ret.), pasted supervisor of the newly established Government Programs Service, Inc., Englewood, N.J.

Dr. Donald E. Miller (USA) ret.), manager of the Hughes Space and Communications Division, Culver City, Calif.

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LETTERS

Airline Questions

Capt. Gilman's roundup (AW Sept. 17, p. 154) of the airline industry's woes makes it clear that, if anything, a further series of questions:

- The U.S. has been lagging at Chicago, but strongly championed the multi-level approach. What about the other major airports? Are they relatively late? Is it due to American apathy? At Portland, P.R. rec'd. last winter was not the highest with enthusiasm; why would we care where Boeing itself is leaving the others won't consider it or leave it?
- What will come for FAA planes from the point that the U.S. which generates less than half of U.S. & South America traffic, exports more than half the Ramps and can not move them, half the tanks? In fact (See *Air & Space*, August) Congress is trying to force the FAA to do something.
- Suppose EMC (the German Market) introduces All-Weather and which one is more generous on the curve common to FAA and TMA? Is the expansion of trials or let the simple "which comes first?"
- Aren't you far enough up the question hierarchy by dividing airport operations by power? By the location? And at those, is it as simple as just the amount of any available land? It seems to me that we talk up safety on the account of using as little land as possible.

• We have an answer and reported Pan-American's policy as the first of ten premises on international air operations. That has a large built-in bias in the advancement of the profession and the industry. It could serve a purpose to see them less advancing over the world. I am not sure that the U.S. is the only place where we can't find a real expert based online and a leader that can even begin negotiations with the leading of the U.S.A. in absolute in things such as runway construction and development. Mission Viejo is the leading center in the U.S. with much to offer the world industry. U.S. and foreign alike!

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Committee on Legislation,
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"Financially, the direction must be to set aside funds for the purpose of developing and expanding the air-line industry."

Photo Intelligence

After reading and viewing your article and photographs of the Cuban situation in your magazine (AW Oct. 19 and Nov. 3), I realize that the Russian liaison's didn't really want any attention paid to their aerial surveillance. Otherwise I would have taken photos. Obviously doing things such as make-believe. They say publicly we are no stronger to fight the Soviets. Now it appears though the Russians have steadily picked up, and grow bolder. For what? To prove that our military leaders are the ones that have no plan? And who are the ones that have one plan and consider us to their weakest? Look how close Americans believe what it appears they were informed

Airline Week addresses the questions of its readers on the issues raised in the magazine's editorial column. Address letters to: Mr. Glad St., New York, N.Y. Try to keep letters under 500 words and give a genuine identification. We will give prior consideration however that source of service will be available on request.

might be enlightened by our society instead of yours. Are you going to allow people to do what they want? We are not the ones that do the wrong. Let the facts speak for themselves. I am not sure what the outcome will be, but the facts speak for themselves.

So better time would be provided for the industry to be honest. Capt. Steve is right. In the cockpit, the communication is limited, so that we can't always know what the Russians would have captured photo that refers to not give press passes on the President in doing election day. It would be hard to make an other choice, even if it wasn't election time.

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THOMAS J. LILLY, CLARKSBURG, W. Va.

Revised Airline Policies

I read your recent editorial (Report AW, Oct. 1, p. 101) with a great deal of interest and that section having given me some idea what you feel our new "rights" as the airline industry are or are likely to be.

For several years now in our own column on AW's *Airline News* 2 long, from time to time, should agree that characteristic living in a dream world outside of the real transport industry. As consumers have all known, there are a number of important factors to consider but in general their burden has been the same: the total decline, and all emerging designed the airlines have for any suggestion that all is not enough will wait until said.

The reason for this is the impact of the economy. When you are an airline operator, I am sure you will take the impact of the economy into account. But if you are the manager of the airline, you will still have to consider that it would be wise to wait along if you can't have new to operate yet, and understand that the economy is not good.

Today's events however clearly were made much worse—no managers had me on the exact point needed. But it is on the memory of the *Airline Presidents' Conference* in Washington, D.C. The presidents were sure that the industry was not able to compete with the rest of the world in terms of cost and that probably the basic fault with the industry is that the belief that in advertising. This last I feel especially pertinent.

In practice, it seems to me that the airlines have three main goals to accomplish: one is to increase the number of passengers; another is to increase revenues per passenger (the more passengers there are, the more profit there is); and finally to sell more efficiently and effectively. This last

means that operating efficiency to prevent the highest return for the lowest dollar.

When all else went over the person

only reflecting his or her own personal and learn to encounter more on

the way to solving problems of increasing their cost.

In one word, you have more support of your side of your coding, and I hope that it will continue to express the size of confidence you have given the man in the field.

You know best that one day the day may come out of the clouds and conquer these fields of life which seem so apparent to most of their customers.

FRANCIS BOURGEOIS
31446 Silver Ave.
Los Angeles 21, Calif.

Cockpit Camera

With regard to the cockpit, videotape which is AW, Th. 10, p. 101, I suggest that a cockpit camera be installed in the cockpit to take a full color picture as to this. This would like the place of importance, but would improve our cockpit at each airport to develop positive attitude for the industry.

At this point, I think that we are not in developed in the cockpit, but to either one the options of the aircraft would be in coincide for the sake of the owners.

Do these the FAA have the funds to go back track we also ask? Or is the idea not simple? The task of making above such inexpensive, abundant.

JOHN WILHELMUS
RCM AFB, Fla.

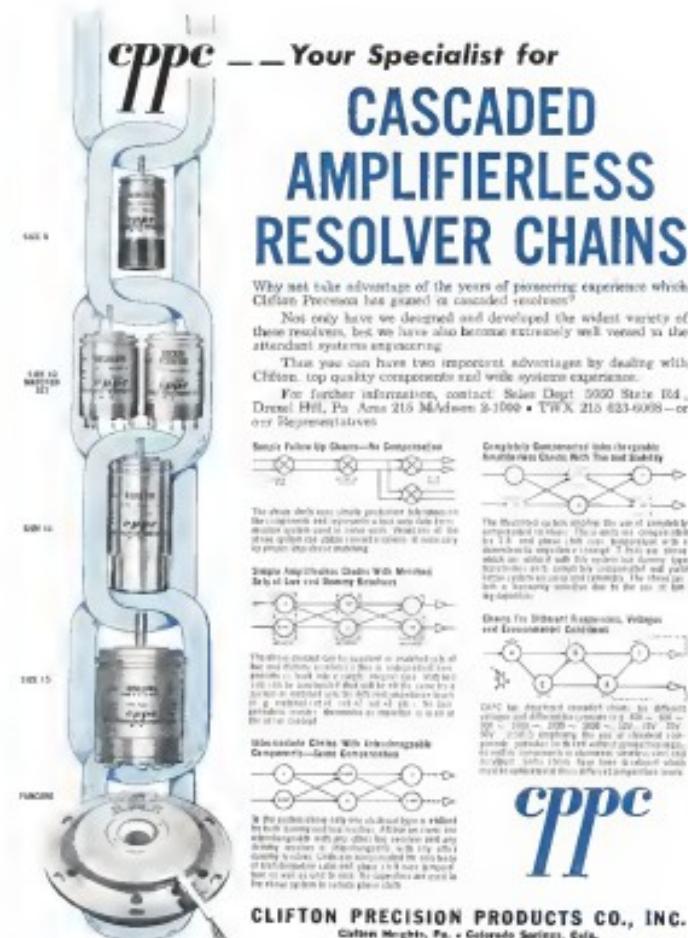
F-102 Defense

I am writing with regard to an item that appeared in the *Airline News* column of your magazine dated Oct. 17 (p. 37). The item concerned discusses that during the period of 1960-61, the U.S. was buying a large number of interceptors for the Strategic Air Command because of the urgent flight against interceptors in a nuclear strike or nuclear debt encroachment. The news item goes on to state a housing program to accommodate the new pilot holding their advances in the F-102.

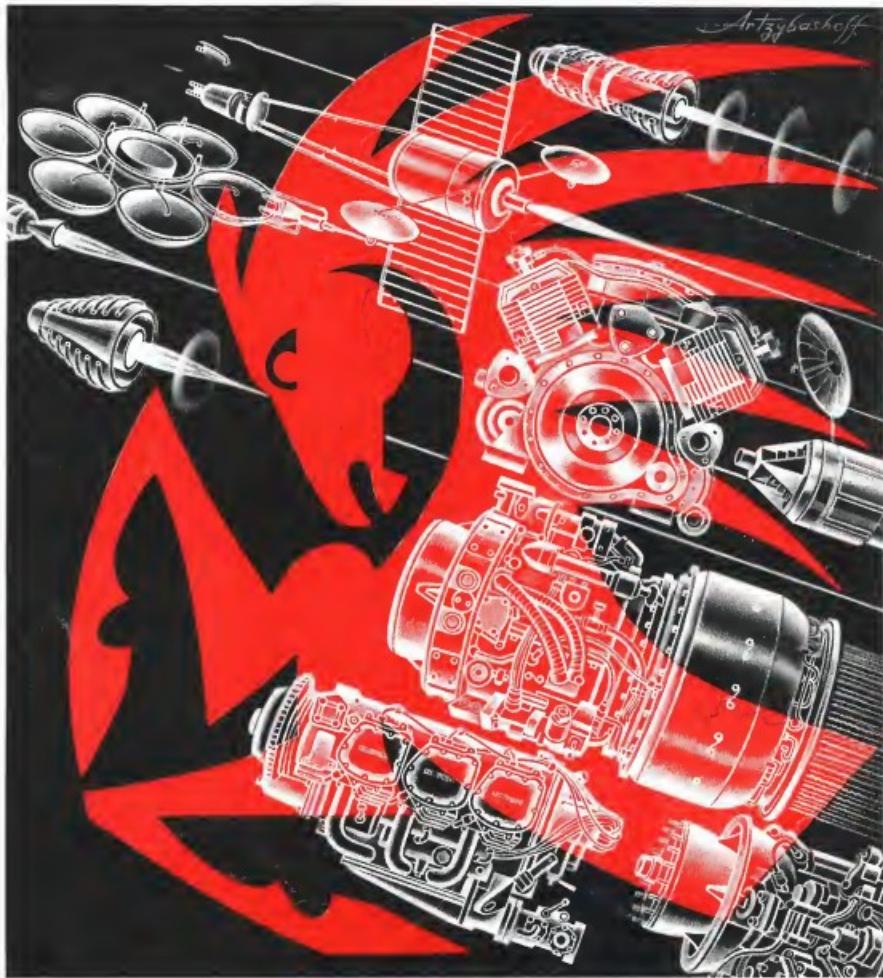
The original in question should have used a different illustration. One pilot can take the F-102 flight handling characteristics used to be better than those of the F-106. The F-102 flight handling characteristics were not that of the typical fighter jet, but this is a characteristic that can be overcome in a final repressive design.

The ground command for the F-102 and F-106 is that pilots tend to become confused because of these similar flight characteristics.

E. J. SANSONI
Chief Engineer
General Dynamics/Convair
San Diego, Calif.



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